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ABSTRACT

This is the Teacher's Guide for six video programs: "Introduction to Ecosystems"; "Tundra"; "Coastal Forest"; "Oceans"; "Impact of Human Habitation"; and "Taiga". The programs are designed to fit into courses for students from grades five through high school in which ecology is taught. They can be used separately or in sequence. Through a survey of the specific features of each of Alaska's four main ecosystems, the programs illustrate and emphasize fundamental concepts of ecology: web of life, food chain, habitat, carrying capacity, natural community, adaptation, predator and prey relationships, plant succession, photosynthesis and energy transfer, and the water cycle. The guide contains a separate lesson for each of the six video programs. Each lesson contains a detailed program summary; student objectives; pre-viewing activities providing advance organizers, including a list of terms to be introduced in the video, post-viewing questions for thought and discussion; and a set of reproducible handouts for deskwork, including a crossword puzzle, word search, and quiz. Extended activities, most of them related to several of the programs, are grouped after the lessons. The guide also contains visual aids for overhead projection or reproduction, a glossary, and a list of further resources. A textbook correlation with six different textbooks is included. (CW)

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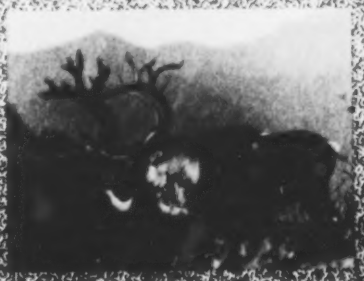

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A Teacher's Guide to

Ecosystems of the Great Land

Six 15-minute video programs on the ecology of Alaska
for junior high and high school students
of biology and life science

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Textbook correlation compiled by

Christopher John Pastore

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Contents

Introduction to the Teacher 1

Lesson 1: Introduction to Ecosystems 2

Lesson 2: Tundra 8

Lesson 3: Taiga 15

Lesson 4: Coastal Forest 22

Lesson 5: Oceans 30

Lesson 6: Impact of Human Habitation 37

Extended Activities 44

Visual Aids 57

Glossary 63

Resources 67

Textbook Correlation 70

Introduction to the Teacher

Ecosystems of the Great Land consists of six video programs, "Introduction to Ecosystems," "Tundra," "Taiga," "Coastal Forest," "Oceans," and "Impact of Human Habitation." These programs are designed to fit easily into any courses for students from grades five or six through high school in which ecology is taught, such as biology, earth science, and geography. They can be taught in sequence, or each may be used separately.

Through a survey of the specific features of each of Alaska's four main ecosystems, the programs illustrate and emphasize fundamental concepts of ecology: web of life, food chain, habitat, carrying capacity, natural community, adaptation, predator and prey relationships, plant succession, photosynthesis and energy transfer, and the water cycle. The four Alaskan ecosystems offer ideal situations for studying these concepts. The fragility of the tundra and taiga, the lush growth of the northern coastal rain forest, and, in the ocean, the combination of teeming life and great vulnerability all offer students varied and fascinating contexts for understanding the complex interdependencies of living things on earth.

This teacher's guide contains a separate lesson for each of the six video programs. Each lesson contains a detailed program summary; student objectives; pre-viewing activities providing advance organizers, including a list of terms to be introduced in the video, post-viewing questions for thought and discussion; and a set of reproducible handouts for deskwork, including a crossword puzzle, word search, and quiz. Extended activities, most of them related to several of the programs, are grouped after the lessons. The guide also contains visual aids for overhead projection or reproduction, a glossary, and a list of further resources.

Lesson

1 Introduction to Ecosystems

Program Summary

This program is an introduction to the six-part video series. General ecological concepts are introduced, including the definition of ecology, the role of the sun, the process of photosynthesis, and the concepts of interrelationships described as chains, cycles, and webs. Brief descriptions are given of the four major Alaskan ecosystems (tundra—alpine and arctic, taiga—upland and wetland, coastal forest—old-growth and second-growth, and oceans).

Ecology means literally "the study of the home." It is the study of living things and their interaction with their physical biological environment.

An *ecosystem* is a "web of life" based on the sun, soil, and water. Energy is transferred from the sun to plants through the process of photosynthesis. This process is the foundation of the food chain that links people, minerals, plants, water, soil, and sunlight into an ecosystem. Temperature is an additional factor that affects an ecosystem.

Student Objectives

After participating in the pre- and post-viewing activities and seeing the introductory video program, students will be able to

1. demonstrate familiarity with the key terms relating to ecology that are listed in the pre-viewing activity and used in the video program
2. indicate on a map rough locations for each of the four ecosystems of Alaska
3. list two characteristics each for tundra, taiga, coastal forests, and ocean ecosystems
4. briefly describe the process of photosynthesis
5. describe general ways in which humans adapt to the environment

Pre-viewing Activities

1. Show students the circumpolar map (page 59) either on an overhead projector or as an individual student handout. Identify Alaska, and ask students to use the map to suggest other places in the world likely to have similar ecological systems.
2. Show students the Alaska ecosystems map (page 57). Point out each ecosystem to students.

3. Introduce the following terms by reading them aloud and writing them on the board. Ask students what the words suggest to them. You might read the definition in the glossary (pages 63–66) of any words that are totally unfamiliar to most of them. Tell them to listen for these terms as they watch the video program.

carbon dioxide	ocean	web	mineral
coastal forest	photosynthesis	chain	oxygen
ecology	taiga	cycle	soil
lichen	permafrost	insect	tundra

Post-viewing Activities

Questions for Thought and Discussion

1. Present students with the blank map of Alaska (page 58), either on an overhead projector or as an individual student handout. Help students plot the rough location of each of the four Alaskan ecosystems. *(See the Alaska ecosystems map on page 57 to check them.)*

2. Present the food-chain graphic for lesson 1 (page 61). Ask students to describe, orally or in writing, each link in the chain. *(They should begin by pointing to the sun and the energy it provides for photosynthesis in plants. They should be able to articulate the complexity of the relationships among plant, hare, and lynx—the plant provides food for the hare, which becomes food for the lynx, and both these animals and the plants eventually decay and provide soil for more plant growth. Students may also suggest that animals, both hare and lynx, spread pollen and seeds from plants and thus encourage their growth. Animal droppings may also become fertilizer for plants, and all animals exhale carbon dioxide which is necessary for plant photosynthesis. Students who make these suggestions may wish to add more arrows to the food chain to represent these connections.)*

3. What are the four major ecosystems of Alaska? *(tundra, taiga, coastal forest, ocean)*

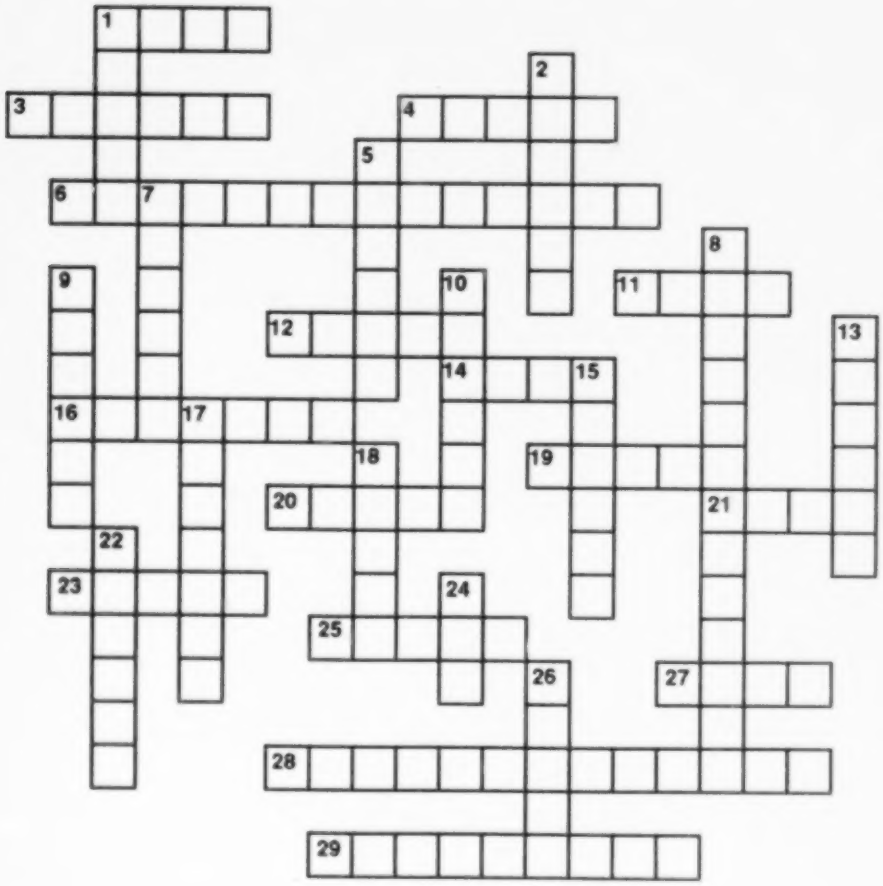
4. What are two characteristics for each of the following four ecosystems: tundra, taiga, coastal forest, ocean? *(Tundra: cold, above or beyond the tree line, frozen soil. Taiga: large stands of spruce and birch, relatively dry, intermediate between tundra and coastal forest ecosystems. Coastal Forest: lots of precipitation, mild climate, abundance of life. Ocean: saltwater, more light at the surface, warm and cold currents)*

5. Tell students that the name "Alaska" comes from words of the Aleutian Indians meaning "great land" or "mainland." Ask them whether, on the basis of what they have seen in the video, the name seems appropriate. (If your class watches the entire series of six video programs, repeat the question after showing the last one.)

Deskwork

Directions: Reproduce the crossword puzzle, word search, and quiz. Distribute them to students for class work or homework. (Answers to all of these are found on page 7.)

Introduction to Ecosystems Crossword Puzzle



Across

1. Black, brown or polar
3. Evergreen tree
4. Life- or bi-
6. Food from sun, water and CO_2
11. Smokey the _____
12. Simple way of looking at ecology
14. Material plants grow in; nicer than dirt
16. Compounds in the soil that plants need
19. Large body of water
20. Usually green
21. Sitka _____
23. A big river
25. H_2O
27. Flies and has feathers
28. The rain forest of Southeast Alaska
29. Largest city in Alaska

Down

1. Lots of these in the taiga
2. Largest state in the USA
5. Living, but not a plant
7. O_2
8. CO_2
9. Red, dog, pink, silver, king
10. Six legs on this animal
13. Ecosystem of the arctic
15. Fungus and algae together
17. The study of the home
18. Forested area around Anchorage
22. Major city in the coastal forest
24. Complex relationship of life forms
26. Circum _____ or _____ bear

Introduction to Ecosystems Word Search

P R N P T L F T J K J G D Q Y M M T R E
H U E Q J V C N U M X R X Q X I O C A X
O F U F A L A S K A O X Y G E N L I N H
T J W A T E R W E B Z Q M G Y V G R I S
O N F R U K H V C X T F C X N Q C C M K
S A L I A P G O F M A F A S E B O U A W
Y R K Z R T X U L J I G R E M Q A M L U
N Y P O I P B K S N G P B W J U S P I B
T E C O L O G Y G M A M O S F V T O V D
H X C Y U Y K O G K G D N O U M A L G X
E E M M J S I H U T B E D I F O L A E A
S J S L X T O C E A N M I L K Q F R U T
I C C O P U Y F T L J I O H H T O M C F
S H Y U Y N H R I I C N X N B E R I F H
A A C P A D C S N T Z E I G X R E P I P
U I L L F R P P S Q Z R D Z S A S K T K
G N E P L A N T E I G A E F U I T T H W
I H T A Q I M S C Y P L Q C E R K B S R
W T U U O L D R T C U I H E Z I I A Y V
M D U Q P V C T D F L I C H E N Q Z R G

There are 20 words here —can you find them?

Here are the words to look for.

ALASKA
CARBON DIOXIDE
CIRCUMPOLAR
CYCLE
INSECT
MINERAL
OXYGEN
PLANT
TAIGA
WATER
ANIMAL
CHAIN
COASTAL FOREST
ECOLOGY
LICHEN
OCEAN
PHOTOSYNTHESIS
SOIL
TUNDRA
WEB

Introduction to Ecosystems Quiz

1. **The four types of Alaskan ecological systems are**
   a. tundra, taiga, savannah, lakes
   b. glacier, rain forest, lakes, rivers
   c. tundra, taiga, glacier, coastal forest
   d. ocean, coastal forest, taiga, tundra

2. **Which Alaskan ecosystem receives the least amount of energy from the sun?**
   a. coastal forest
   b. tundra
   c. savannah
   d. taiga

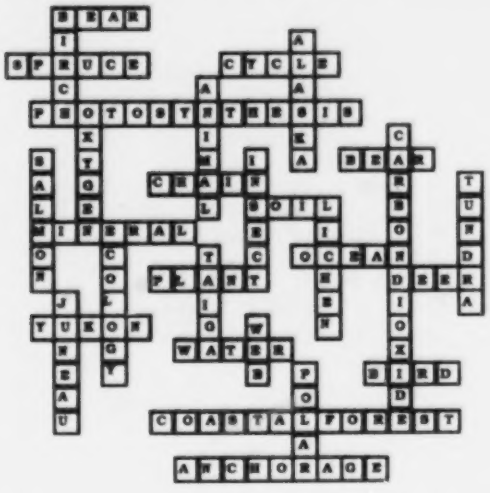
3. **"Ecology" comes from the Greek language and means, literally**
   a. study of the home
   b. study of conservation
   c. preventing economic development
   d. study of living things

4. **In the process of photosynthesis**
   a. plants take in oxygen and release carbon dioxide
   b. plants take in carbon dioxide and release oxygen
   c. animals take in oxygen and release carbon dioxide
   d. animals take in carbon dioxide and release oxygen

5. **Lichen is**
   a. a type of moss
   b. a type of cloth used to make tablecloths
   c. a combination of fungus and bacteria
   d. a combination of fungus and algae

Answer Key

Introduction to Ecosystems Crossword Puzzle



Introduction to Ecosystems Word Search

PHOTOSYNTHESIS
ECHAIN
CYCLE
WATER
PLANT
ALGAE
TUNDRA
LEAF
GRASS
SWAMP
KELP
INSECT
ABLE
OTTER
TAIGA
ANIMAL
MINERAL
XYLEM
CARBONDIOXIDE
SOIL
GRASS
COASTALFOREST
CIRCUMPOLAR
ANIMAL

Introduction to Ecosystems Quiz

1—d; 2—b; 3—a; 4—b; 5—d

Lesson

2 Tundra

Program Summary

The program introduces the two types of tundra, arctic and alpine. Arctic tundra spreads across vast areas of Alaska. Alpine tundra can be found at high elevations.

Alpine tundra is introduced by showing two teenagers walking down a Chugach mountain, examining the vegetation as they go. Motion shots show a variety of alpine tundra animals, and then the program develops the concept of an ecological community. The interaction of water freezing and thawing, soil created by the action of wind and water, slow-growing, specially adapted plants and lichens, caribou, wolves, and other animals create a complex food chain. The concepts of *carrying capacity* and *ecological community* are presented through a discussion of the habitats and relationships among ground squirrels, fox, caribou, and wolves.

The cycle of seasons is even harsher in the arctic tundra. Plants and animals adapt through a number of methods, including dormancy and insulation. Caribou and a few other animals tolerate the harsh conditions, and the arctic supports a large population of migratory birds. The short summer and long days both require and support the rapid growth of the young birds. The Inupiat and Yupik Eskimos have learned how to live in the arctic tundra. Their traditional close relationship to the environment does not threaten its fragile balance, but the discovery of the rich mineral resources of the region—oil, gas, and coal—may bring profound changes.

The program stresses the importance of education on arctic issues. Because of the small number of species and the small populations within them, balance is more critical. Adverse affects on one may have serious complications for the whole community.

Student Objectives

After participating in the pre- and post-viewing activities and seeing the video program, students will be able to

1. demonstrate familiarity with the key terms relating to the ecology of the tundra that are listed in the pre-viewing activity and used in the video program
2. list ecological characteristics of tundra (physical, geographic, energy, and ecological)
3. differentiate arctic tundra from alpine tundra, naming for each the characteristic animal and plant species and the affect of the cycle of seasons

4. describe the adaptations of several plant and animal species for survival in the tundra

5. discuss the effect of traffic (foot and mechanical) on the tundra; the length of recovery time; and the plant succession that would likely occur

6. discuss the ecological and economic importance of the arctic tundra

Pre-viewing Activities

1. Preview the circumpolar map (page 59) and the Alaska ecosystems map (page 57). Tell students that they are going to watch a video program about the Alaskan tundra. Point out that it covers almost half the state on the map. Ask them what associations they have with the word *tundra*. List their responses on the board.

2. Ask students to watch for the conditions that make survival in the tundra difficult for living things. They should note the special characteristics of tundra plants and animals that help them survive despite the harsh environment.

3. Introduce the following terms, which are used in the video program. Find out how many are familiar to the students, and tell them to listen for their use in the program. The glossary (pages 63–66) contains definitions of any that are unknown to most of the students.

adaptation	arctic	migrate	Inupiat
community	ecology	tundra	solstice
habitat	hibernation	circumpolar	Yupik
latitude	permafrost	ecosystem	tree line
succession			

Post-viewing Activities

Questions for Thought and Discussion

1. What are 10 characteristics of "tundra"? *(Answers may vary. Suggested answers include: located between tree line and summer snow line; receives little precipitation; the growing season lasts for only a few months; experiences long periods of extreme cold; thin soil over permafrost; relatively few species; sparse human population; plants grow close to the ground; the ecosystem is fragile; most of the plants are perennial.)*

2. Reproduce or project the blank map of Alaska (page 58), and ask students to locate alpine and arctic tundra.

3. What are two major differences between arctic and alpine tundra? *(Alpine tundra is found above the tree line on mountains, and arctic tundra is found beyond the tree line in the north. Even though there is little precipitation, Arctic tundra is frequently boggy because the permafrost traps what little rain or snow does fall. Alpine tundra, on the other hand, is dry because the water runs down the slope.)*

4. Why do relatively few species of plants and animals live on the tundra? *(Harsh conditions exist, such as extremes of temperature, wind, permafrost, lack of precipitation, and extremes of daylight.)*

5. According to the video program, tire tracks will still be visible for as long as 20 years after they are made in the tundra. Why is the tundra is so slow to recover? *(Answers may vary but should include at least one of the following: growing season is extremely short; things take a long time to decompose; once the permafrost layer is exposed or melted, it continues to melt and slump; the plants grow very slowly and add only a few leaves and centimeters of growth per year.)*

6. What are some characteristics of plants and animals that enable them to survive in the tundra? *(Plants grow close to the ground, are perennial, and have thick leaves. Animals migrate great distances, burrow underground, hibernate, or grow exceptionally heavy insulating coats over thick body fat.)*

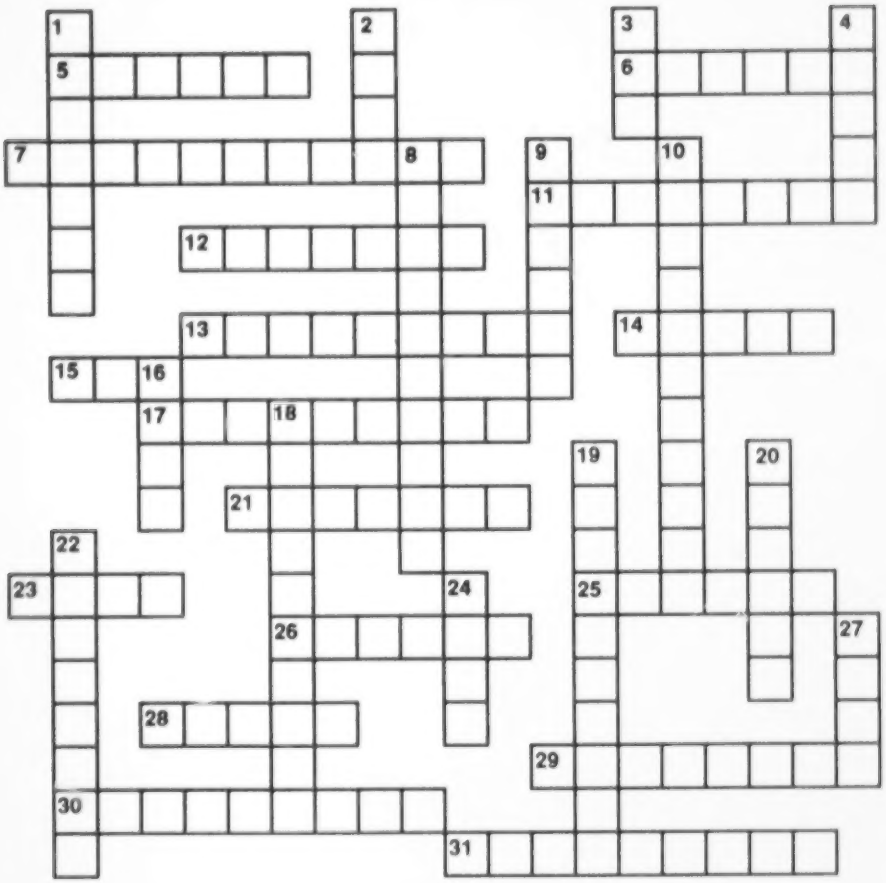
7. Describe the relationship between ground squirrel and fox populations. *(Answers will vary. The populations are dependent on one another. As the ground squirrel population rises, the fox population will increase. Similarly, when the ground squirrel population declines, the fox population will decline. They are different in that the fox population trends will lag behind the ground squirrel population changes. Also, there are many more ground squirrels than foxes.)*

8. List two reasons why the arctic tundra is important. *(Answers will vary. Possible answers include: the tundra is the breeding ground of many species of birds that migrate all over the world; the tundra area has many natural resources of use to human populations; it is the home of the Inupiat people.)*

Deskwork

Directions: Reproduce the crossword puzzle, word search, and quiz. Distribute them to students for class work or homework. (Answers to all of these are found on page 14.)

Tundra Crossword Puzzle



Across

5. Where the sun doesn't set on June 22
6. A large country with lots of tundra
7. The area above the Arctic Circle
11. Lines parallel to the Equator
12. Northern Eskimo
13. To move from place to place
14. Perma _____
15. The complex interrelationship of life
17. The relationship of living things with the physical environment
21. The study of the ecosystem
23. A cousin of the dog
25. Between tree line and snow line
26. European country with tundra
28. Western Eskimo
29. Major city just north of the Arctic Circle
30. Group of living things
31. A large island, almost a continent, above the Arctic Circle

Down

1. Where plants and animals live
2. _____ sheep
3. A common form of water in the tundra
4. A bald bird "that isn't really bald."
8. Increases the ability to live in the tundra or anywhere else
9. Mountain top tundra
10. A deep sleep
16. Polar, grizzly, black
18. The series of plants that come to a cleared area
19. Lots of oil here
20. Largest city on the North Slope
22. Longest and shortest days
24. _____ deer
27. Mickey and Minnie were two

Tundra Word Search

R	N	E	C	O	L	O	G	Y	U	P	I	K	P
H	I	B	E	R	N	A	T	I	O	N	T	L	F
O	I	L	T	S	U	C	C	E	S	S	I	O	N
J	C	O	M	M	U	N	I	T	Y	K	J	G	D
Q	Y	M	M	E	C	O	S	Y	S	T	E	M	T
R	E	U	E	Q	M	I	G	R	A	T	I	O	N
A	R	C	T	I	C	L	A	T	I	T	U	D	E
J	V	C	I	R	C	U	M	P	O	L	A	R	C
W	O	L	F	A	D	A	P	T	A	T	I	O	N
N	U	M	X	T	U	N	D	R	A	R	X	Q	X
I	N	U	P	I	A	T	C	A	R	I	B	O	U
I	O	N	O	R	T	H	S	L	O	P	E	X	F
U	F	P	O	L	A	R	B	E	A	R	L	H	J
Z	Q	M	G	S	O	L	S	T	I	C	E	Y	V

There are 19 words here —can you find them?

Here are the words to look for.

ADAPTATION
CARIBOU
COMMUNITY
ECOSYSTEM
INUPIAT
MIGRATION
OIL
SOLSTICE
TUNDRA
YUPIK
ARCTIC
CIRCUMPOLAR
ECOLOGY
HIBERNATION
LATITUDE
NORTH SLOPE
POLAR BEAR
SUCCESSION
WOLF

Tundra Quiz

1. **Why does alpine tundra tend to be drier than arctic tundra?**
   a. Arctic tundra receives more precipitation.
   b. Arctic tundra is underlain by a layer of permafrost that water cannot penetrate.
   c. Arctic tundra has a thicker soil layer, and can hold more water.
   d. Because arctic tundra is on a slope, rain and melted snow run off of it rather than settling in pools.

2. **Which of the following is NOT a characteristic of alpine tundra wildflowers?**
   a. short: grow close to the ground to preserve warmth
   b. perennial: do not die at the end of one summer but instead come up again the next summer to produce a few more leaves
   c. pale: have light-colored flowers and leaves to absorb more of the sun's rays
   d. texture: leaves are thicker than average and sometimes covered with fine velvety hairs to preserve warmth

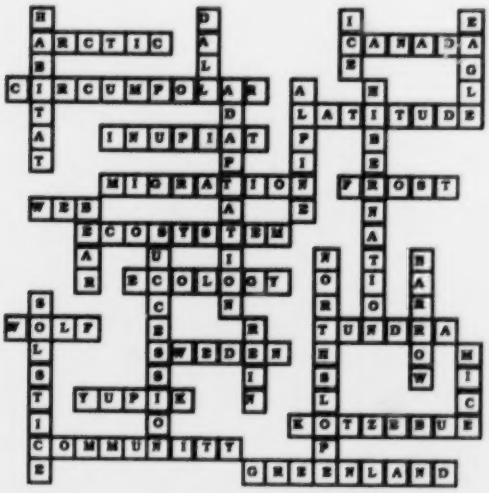
3. **Which of the following pairs of animals do NOT live on the tundra?**
   a. caribou, mountain goat
   b. black bear, black tailed deer
   c. marmot, human
   d. wolf, arctic hare

4. **What makes the tundra fragile?**
   a. Plants grow so slowly that it takes them many years to recover from damage done to them.
   b. Heavy equipment moving across the tundra can easily rip it up, allowing the oil trapped beneath the tundra surface to rise and pollute the area.
   c. So many varieties of plants and animals live on the tundra that if one of the varieties is disturbed, the effects of that disruption "ripple out" and damage the rest of the plants and animals as well.
   d. All of the above.

5. **Which of the following describes the tundra?**
   a. It is the land of the arctic and high mountains.
   b. It has a cold climate and receives little precipitation.
   c. It has a short growing season.
   d. All of the above.

Answer Key

Tundra Crossword Puzzle



Tundra Word Search

.	.	E	C	O	L.	O	G	Y	U.	P	I	K	.
H	I	B	E	R	N	A	T	I	O	N	.	.	.
O	I	L	.	S	U	C	C	E	S	S	I	O	N
.	C	O	M	M	U	N	I	T	Y	.	.	.	.
.	.	.	.	E	C	O	S	Y	S	T	E	M	.
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A	R	C	T	I	C	L	A	R	I	T	U	D	E
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W	O	L	F	.	C	D	A	T	A	L	.	.	.
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.	.	.	.	S	O	L	S	E	A	C	.	.	.
.	.	.	.	.	.	.	.	T	I	.	E	.	.

Tundra Quiz

1—b; 2—c; 3—b; 4—a; 5—d

Lesson

3 Taiga

Program Summary

The taiga begins where the tundra ends. The program shows the transition zone between tundra and a black spruce forest of the taiga and highlights differences between the two areas. The video presents some of the trees of the taiga. Graphics and a map indicate its size and extent.

A definition of *taiga* ("swamp forest") precedes a description of its location, temperature, and rainfall. The program points out the connection between rainfall, fire, and the variable day length. A visual sequence shows white spruce in five stages of development. A focus on a dead spruce shows the relationships of living things of the taiga.

Various large mammals live in the taiga, including moose, wolves, red fox, wolverines, and bears. Smaller mammals and birds of the taiga are also presented. The video focuses on the predator-prey relationship, featuring two examples, lynx-hare and fox-lemming. The conclusion reviews the complexity of the ecological relationships of the taiga and compares the complexity of the tundra and taiga ecosystems.

Student Objectives

After participating in the pre- and post-viewing activities and seeing the video program, students will be able to

1. demonstrate familiarity with key terms relating to the ecology of the taiga that are listed in the pre-viewing section and used in the video program
2. locate on a map the taiga areas of Alaska
3. name physical, geographic, energy, and ecological characteristics of the taiga, and those that differentiate upland and wetland taiga
4. describe the life cycle of a spruce and show its ecological relat'onship with another species of plant or animal
5. describe the relationship between predators and prey
6. describe plant succession in the taiga

Pre-viewing Activities

1. Show students the Alaska ecosystems map (page 57). Point out the taiga region. Mention that two of Alaska's largest cities, Fairbanks and Anchorage, are located in the taiga.

2. Discuss the word *cycle* with students. Ask them what aspects of life on earth are cyclical. Encourage them to suggest such things as the seasons, day and night, water, soil, oxygen, birth/death.

3. Ask students to watch for the conditions that make taiga living conditions unique. What special characteristics do taiga plants and animals have that help them adapt?

4. List the following terms for the students. Suggest that they watch and listen for their use in the program. Definitions can be found in the glossary (pages 63–66).

adaptation	prey	ecology	solstice
conifer	succession	habitat	taiga
ecosystem	upland	predator	wetland
old-growth forests	carrying capacity		

Post-viewing Activities

Questions for Thought and Discussion

1. Ask students to compare upland and wetland taiga. *(Upland taiga is drier, primarily white spruce and birch forest, while wetland taiga is primarily black spruce and has a high water table.)*

2. Ask students what is meant by *carrying capacity*. *(Help them understand that the carrying capacity of an area may be different for different species. One hundred forty squirrels might live in an area that can hold only two owls. The carrying capacity of an area for even a single species might vary from year to year due to changes in vegetation, rainfall, competition from domestic species, and other factors.)*

3. Ask students to name some factors that determine the carrying capacity for a species or animal. *(amount and arrangement of food, water, shelter, space, climate, predators)* Ask students whether they can think of any instances in which a species has exceeded the carrying capacity of its habitat. *(Some students may recall problems of wild burros in the Grand Canyon, wild horses in parts of the West, or deer in national parks and other areas of the country.)*

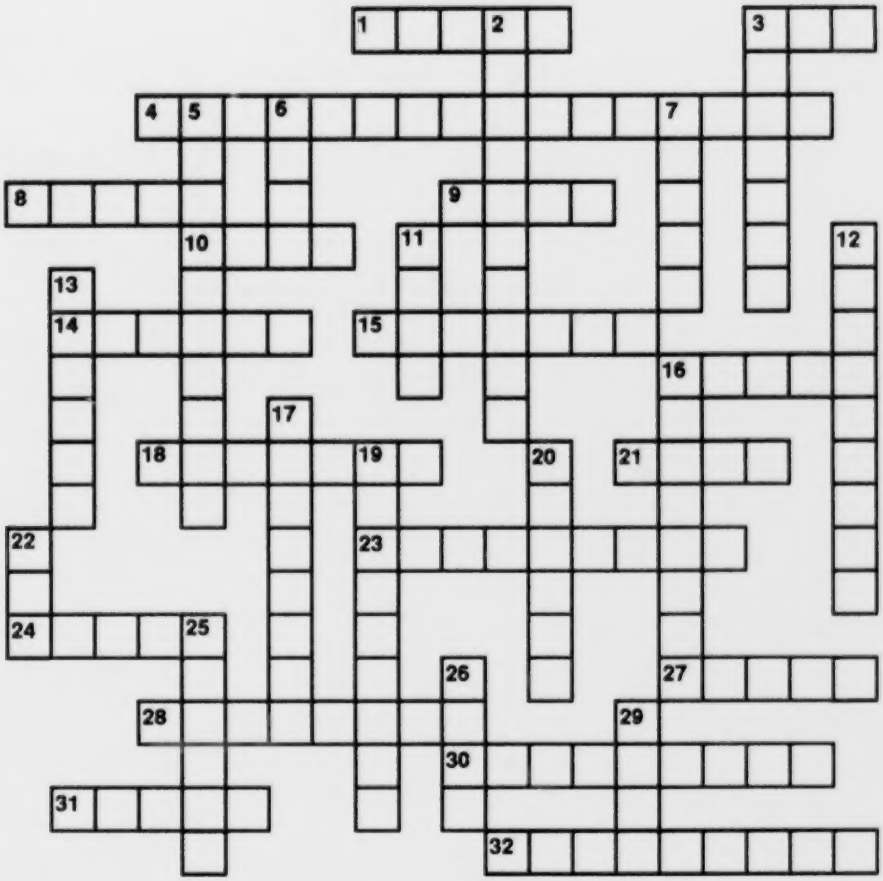
4. Ask students what happens when humans exceed the carrying capacity of the area in which they are living. *(In most cases, humans will import the food, water, and supplies they need from another place. In some cases, people will change their living habits to adapt to the situation at hand. In other cases, people will move to a place that is better able to support them, or will die. In some parts of the world, great famines occur because the human population has exceeded the carrying capacity of an area, and money for trade or means to move are not available.)*

5. Ask students whether they are aware of any current problems caused by either people or animals having exceeded the carrying capacity.

Deskwork

Directions: Reproduce the crossword puzzle, word scramble, and quiz. Distribute them to students for class work or homework. (Answers to all of these are found on page 21.)

Taiga Crossword Puzzle



Across

1. Largest member of the deer family
3. Complex interrelationship of life
4. The size of population a habitat will support
8. Coniferous forests of the north
9. A large plant that doesn't flower
10. An animal eaten by another animal
14. Dry, birch taiga
15. Where plants and animals live
16. Animal sometimes seen in taiga; more often in alpine tundra
18. Tree that bears cones
21. Not an orange-berry, a _____ berry
23. Forest that has not been disturbed
24. Lots of these transportation ribbons in the taiga
27. Bald bird
28. Animal that hunts other animals
30. Largest city of the Alaskan taiga
31. Tree found in upland taiga
32. Makes good jelly and waffles

Down

2. Slow change of plants in an area
3. The taiga that has lots of bird nests and moose habitat
5. A trait that increases an animal's chance of survival
6. A pink perennial wildflower; _____ hip jelly is good!
7. Recurring succession of living things
11. Black, grizzly
12. A berry, not black or boysen
13. The ecosystem between tree line and ice
16. Longest day of the summer and winter
17. Both tall and dwarf; it grows in areas that have been burned
19. The system of living things and their environment
20. Lots of trees
22. Covering on mammals
25. A coniferous tree, especially common in wetland taiga
26. _____ berry; great with turkey
29. Pine or ice cream _____

Taiga Word Scramble

Write the word described by these phrases in the spaces to the right of the definition. One letter fits in each box or line.

1. Dominant trees in the taiga are spruce and

   ☐_ _ _ _.

2. The number of certain species that a given habitat will support.

   _ _ _ _ _ ☐_ _ _ _ _ _ _ _ _ _

3. "Swamp forest."

   _ ☐_ _ _

4. Animal that eats prey.

   _ _ _ _ _ ☐_ _

5. Northernmost state where taiga is found.

   _ _ ☐_ _ _

6. Type of forest that grows after a forest has been cut or burned.

   _ _ _ _ _ _ _ _ _ _ ☐_

7. Animal that eats plants.

   ☐_ _ _ _ _ _ _ _

Unscramble the letters in the boxes. What word do you get? What does that word mean? _____

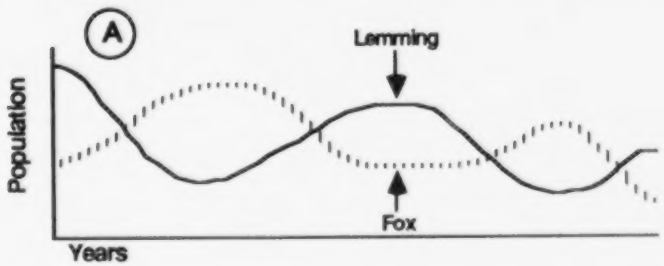
_____

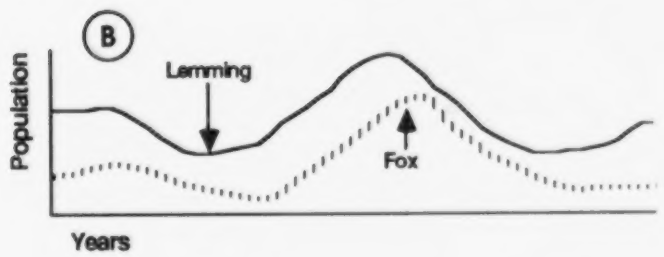
_____

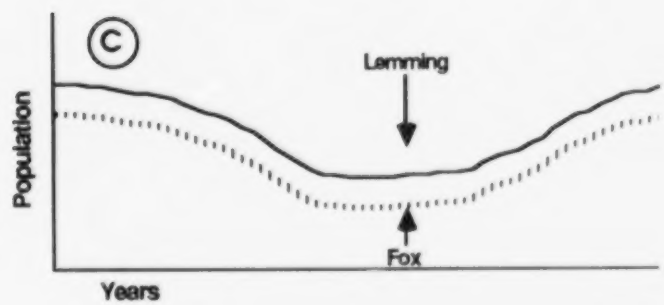
Taiga Quiz

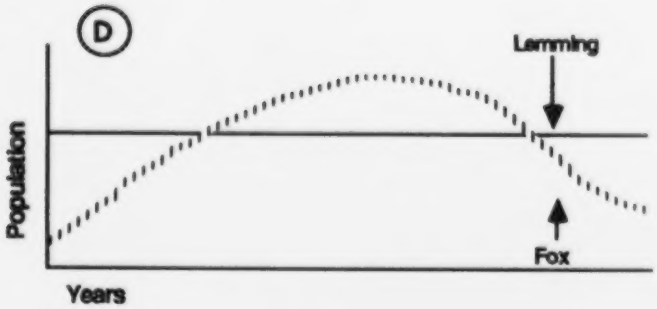
1. **Which of the following statements best describes the Alaskan taiga?**
   a. The climate is mild and wet. Spruce and hemlock have huge trunks at least 10 feet in circumference. Thick moss covers the ground.
   b. The climate is mild and dry. Thick stands of aspen and grassy meadows support abundant wildlife.
   c. Spruce trees grow fairly close together, accompanied by birch trees in the higher, drier areas.
   d. The tropical climate produces gorgeous and abundant wildflowers. A white sandy beach attracts any visitors who make it past the vicious giraffes and ground sloths.

2. **Using your knowledge of the lynx-hare cycle, decide which of the following four graphs is the most likely to represent the lemming-fox cycle? (Lemmings are small plant-eaters. Foxes eat lemmings.)**









3. A bog's carrying capacity for dragonflies has decreased. What might be the cause?

a. The number of frogs which eat dragonflies decreased.

b. The bog was sprayed to kill the mosquitoes that the dragonflies eat.

c. Both of the above.

d. Neither of the above.

4. What would happen to Alaska's hare population if all of their predators were killed?

a. Hares would be healthier because sick ones could rest and get well instead of spending their energy escaping from predators.

b. The hares would continue to reproduce until they had exceeded the land's carrying capacity, at which point many would starve.

c. Willows would grow taller and stronger.

d. Over several generations, rabbits would become larger and stronger.

5. Which best describes a human being's habitat?

a. The physical environment in which the person lives, works, plays, and eats. It must provide adequate food, water, shelter, and space.

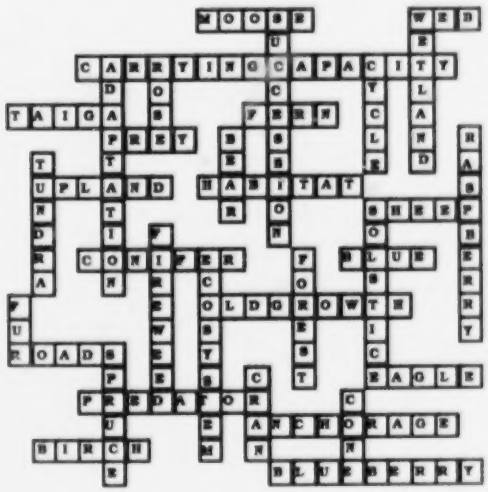
b. The kind of food that the person eats, and the farms and feedlots that supply the food.

c. The interrelationships between the person and the surrounding world, including relationships with living things and with the climate, soil, air, and water.

d. The role or job that the person plays in his or her community.

Answer Key

Taiga Crossword Puzzle



Taiga Word Scramble

1. birch
2. carrying capacity
3. taiga
4. predator
5. Alaska
6. second growth
7. herbivore

The scrambled word is *habitat*, which is defined as the place where an animal lives that provides food, water, shelter, and space in the proper arrangement.

Taiga Quiz

1—c; 2—b; 3—b; 4—b; 5—a

Lesson

4 Coastal Forest

Program Summary

Ice fields, glaciers, waterfalls, and killer whales characterize the coastal forest region of Alaska, where the climate is cool and cloudy in the summer and the winters are mild. Graphics and footage shot in the coastal forests illustrate the water cycle.

Old growth forest, undisturbed for many years, has a stable population of plants, called *climax vegetation*. Second-growth forests result from fire, clear-cutting, avalanche, or other major factors. Grasses and small plants succeed in time to the large trees found in the old-growth forest. A dead tree provides a "nursery" for seedlings that take root along the line of the downed trunk.

Animals of the forest, such as the Sitka black-tailed deer, find protection from snow and predators in the old-growth forest as well as abundant food. Birds featured include eagles, hawks, owls, grouse, ravens, and sea gulls.

The video concludes with a discussion of clear-cut logging and its effect on salmon habitat, an intertwined economic and ecological concern of the coastal forest.

Student Objectives

After participating in the pre- and post-viewing activities and seeing the video program, students will be able to

1. demonstrate familiarity with the key terms relating to ecology that are listed in the pre-viewing activity and used in the video program
2. identify on a map areas of Alaskan coastal forests
3. list physical, geographic, energy, and ecological characteristics of coastal forests
4. describe differences between old-growth forests and second-growth forests and characteristic plant and animal species of each
5. demonstrate an understanding of the water cycle by drawing and labeling a diagram
6. discuss timber harvesting as an environmental and economic issue

Pre-viewing Activities

1. Show students the Alaska ecosystems map (page 57) and point out the location of the coastal forests.

2. Tell students that the program they will see is about *rain forests*, and ask them what the term means to them. Ask them where they expect to find rain forests. *(Some students may suggest equatorial forests or jungles.)* Ask students to speculate about similarities and differences between rain forests near the equator and those in Alaska.

3. Write the following terms on the board, and ask students how many they are familiar with. Tell them to listen for their use in the program. Definitions can be found in the glossary (pages 63–66).

adaptation	photosynthesis	clear-cutting	vapor
carrying capacity	rain forest	transpiration	ecology
condensation	succession	evaporation	habitat
old-growth forest	precipitation	ecosystem	climax
second-growth forest	atmosphere	water cycle	

Post-viewing Activities

Questions for Thought and Discussion

1. What are some characteristics of the coastal forest? *(Answers will vary, but should include the following: abundance of precipitation; near the ocean; mostly hemlock and spruce forests; mild climate; many streams, lakes, and glaciers; large vegetation; dense underbrush; moss on forest floor; rich timber resources; rich in animal life.)*

2. Present students with the blank map of Alaska (page 58), either as a reproducible handout or on an overhead projector. Have them indicate where coastal forests would be found.

3. Compare old-growth and second-growth forests, and indicate whether the forests described below are old-growth (climax) or second-growth. *(Old-growth forest is stable, or has climax vegetation. It changes little and supports a variety and abundance of wildlife and plant life. Second-growth forest vegetation is all the same age and often of the same species. There will be more ground cover to browse.)*

   a. Forest fire occurred there 30 years ago. *(second-growth)*

   b. Forest fire occurred there 100 years ago. *(second-growth)*

   c. Large, healthy deer population. *(old-growth)*

   d. Forest that, if left undisturbed, will look about the same a couple of hundred of years from now as it does now. *(old-growth)*

   e. Spruce trees 30" in diameter. *(old-growth)*

   f. Closely spaced, evenly aged trees. *(second-growth)*

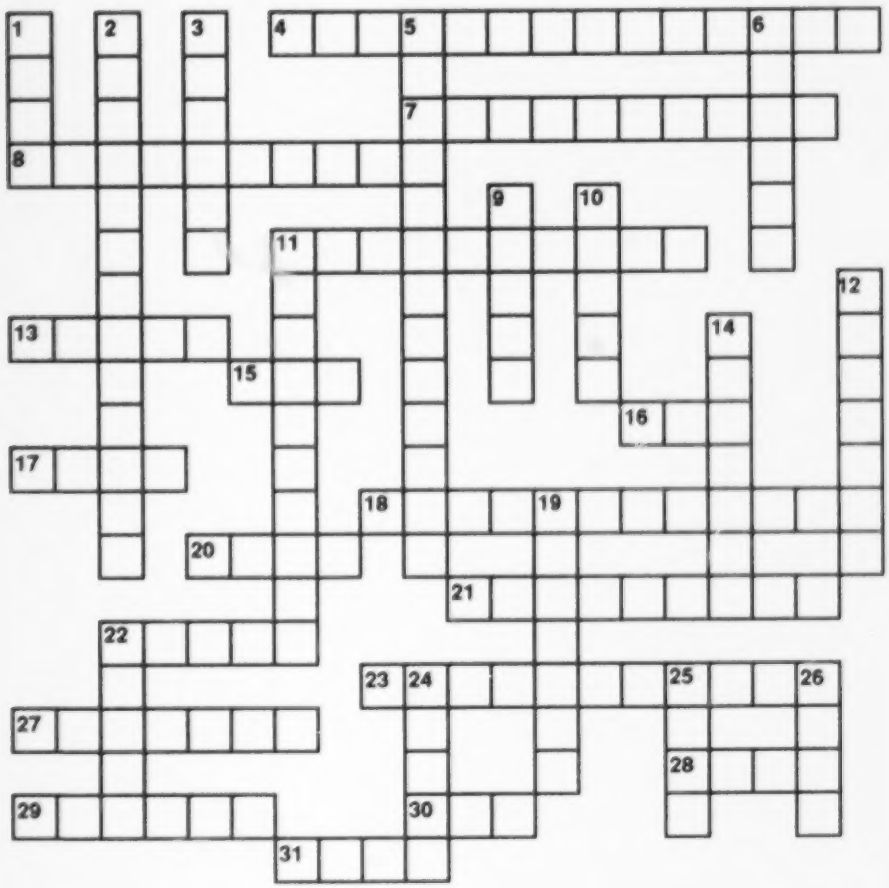
5. What are two ways second growth forests are created? *(clear cut logging, forest fires and wind storms)*

6. By reproduction or on an overhead, present students with the diagram on the water cycle (page 62). Either orally or in writing, ask them to articulate the steps in the cycle and describe the process by which water is transformed at each stage. *(Heat from the sun causes evaporation of water, mainly from the oceans. The moisture, in the form of vapor, rises and forms clouds as it cools. Further cooling causes the vapor in the clouds to condense and fall to the ground as precipitation, either rain or snow. The precipitation either falls directly back into the oceans, or it falls over land, running off mountains or soaking into the earth until it eventually seeps into waterways entering the ocean, where the cycle begins again.)*

Deskwork

Directions: Reproduce the crossword puzzle, word scramble, and quiz. Distribute them to students for class work or homework. (Answers to all of these are found on page 29.)

Coastal Forest Crossword Puzzle



Across Clues

4. Process plants use to make food
7. Air
8. Replacement of one type of plant by another
11. Trait which helps an animal survive
13. H_2O
15. A cute guy found in the forest
16. The complex relationship of living things
17. What the coastal forest has lots of
18. Forms dew
20. Sitka, white-tailed are types
21. The system of living things and their environment
22. Oxygen, water, life
23. Water to vapor
27. Not inland
28. Spongy green carpet
29. Major city of the coastal forest
30. _____ -growth forest
31. An omnivore high on the food chain

Down Clues

1. Mammal that flies at night
2. Rain, snow, sleet, hail
3. Lots of trees
5. Leaves give off water this way
6. An evergreen
9. Bald bird
10. A city and a tree
11. The blanket of air
12. Cutting down trees
14. Where plants and animals live
19. The study of living things and their environment
22. A simple way to diagram the relationship of living things
24. Water in the gas form
25. Animals of the coastal forest are rarely this
26. Where eggs are found

Coastal Forest Word Search

O S U C C E S S I O N R N P T T E L
L C A R R Y I N G F T J K J G R V D
D R A I N F O R E S T T P Q Y M A A C
G H A B I T A T M T R H E U P N P A
R E V A P O R Q J V C O N U R S O P
O M X R X Q X I O X C T F U E P R A
W W F L H S J Z Q M O O G Y C I A C
T A E V G A S N F R N S A U I R T I
H T C K H L V C X F D Y T A P A I T
F E O X N M Q K A L E N M D I T O Y
O R S E C O L O G Y N T O A T I N I
R C Y A P N G O F M S H S P A O F S
E Y S E B W R K Z R A E P T T N T X
S C T U L J G E M Q T S H A I U Y P
T L E O I P B K S N I I E T O P W J
U E M I B G M M F V O S R I N V D X
C L E A R C U T T I N G E O C Y U Y
K S E C O N D G R O W T H O N O G K G

There are 20 words here —can you find them?

Here are the words to look for.

ADAPTATION
ATMOSPHERE
CAPACITY
CARRYING
CLEAR CUTTING
CONDENSATION
ECOLOGY
ECOSYSTEM
EVAPORATION
HABITAT
OLD-GROWTH FOREST
PHOTOSYNTHESIS
PRECIPITATION
RAIN FOREST
SALMON
SECOND GROWTH
SUCCESSION
TRANSPIRATION
VAPOR
WATER CYCLE

Coastal Forest Quiz

1. **If a coastal forest was cleared of all plant life, certain plants would re-establish themselves in a predictable order. Which of the following best describes those plants and that order?**

   a. first: fireweed, ferns, and dogwood
   second: devil's club, alder, and currents
   third: spruce and hemlock saplings
   fourth: spruce and hemlock trees

   b. first: moss and lichens
   second: willows, fireweed, and mushrooms
   third: cottonwood and aspen saplings
   fourth: aspen and spruce trees

   c. first: devil's club, alder, and spruce saplings
   second: fireweed, grass, and birch saplings
   third: moss on fallen logs
   fourth: spruce and alder trees

   d. first: cranberry bushes and moss
   second: devil's club, willow, and alder
   third: birch and cottonwood trees
   fourth: birch and hemlock trees

2. **Which of the following statements about the water cycle is *false*?**

   a. Water that falls as rain in Alaska may have evaporated from someone's tea kettle in Japan last month.

   b. The water that is on and above the earth right now is the same water that was on and above the earth a thousand years ago.

   c. A drought on one continent is caused by people on other continents using too much water. (A drought is a severe lack of rainfall.)

3. **Why is the vegetation of coastal forests more lush than it is in other parts of Alaska?**

   a. The soil in coastal forests is better.

   b. Coastal forests have a mild, wet climate.

   c. There are less tree diseases in coastal forests.

   d. Coastal forests have been growing for a long enough period of time to have reached a climax state.

4. Which of the following is NOT a reason why old-growth forests support more wildlife than do second growth forests?

a. During the winter large mammals find it easier to travel through old-growth forests because the canopy of trees reduces snow accumulation.

b. The variety of plants and of sizes of trees in an old-growth forest provides several different kinds of habitat for forest animals.

c. Eagles, owls, hawks, and osprey are found most often in old-growth forests because they prefer old, tall trees for their nesting sites.

d. Animals prefer the shade of old-growth forests because it helps them hide from predators.

5. Because trees grow back again after being cut, why is there opposition to the clear-cutting of Southeast Alaska's old-growth forests?

a. There is no opposition.

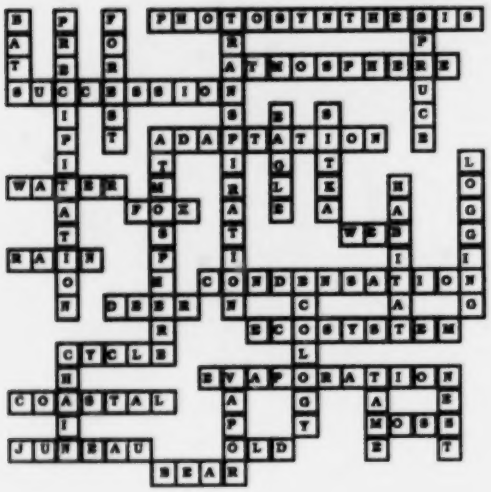
b. Clear-cutting can lead to soil erosion, the contamination of fish spawning streams, and the disruption of wildlife habitat.

c. Old-growth forests are more expensive to cut, and yield less lumber than do the more densely packed second-growth forests.

d. People who oppose clear-cutting don't understand that trees are a renewable resource, i.e., that the forest will grow back again, following a timber harvest.

Answer Key

Coastal Forest Crossword Puzzle



Coastal Forest Word Search

```
O S U E C C R E S I S I O N . . . T E .
L C A A R R Y . . . . . . . . R V A .
D R A V I E S . . . . . . . . A P C
G H . . B N F T O R . . . . . P O R A
R . W A . I . . . . . . . . R A P C
O W A T E R C Y C L E S . . . E T I
T H E . . . . . . . . . . . C I O T
F O R E S T E C O S Y S T E M E . N
O R E S T . . . . . . . . . . . . .
L E S . A C R O C U D T G T I O . . .
```

Coastal Forest Quiz

1—A; 2—C; 3—B; 4—D; 5—C

Lesson

5 Oceans

Program Summary

The ocean is the world's largest ecosystem. Saltwater seas cover over 70 percent of the earth's surface. A much greater number and variety of living things live in the ocean than on land.

The oceans powerfully affect the world's weather. They provide most of the moisture upon which life depends as water evaporates to form clouds that carry water inland.

To Alaska, the most important creature in the ocean ecosystem is the salmon. Five different species hatch in fresh water, go to sea, and return to spawn. The salmon's role in its ecosystems is a microcosm of the role of many living things in the complex ecosystems of the earth. Archival pictures from the early twentieth century demonstrate the economic importance of salmon.

Large numbers of sea mammals live in the Alaskan oceans. These include sea lions, seals, walrus, otters, polar bears, and whales, especially the bowhead, beluga, and humpback whales. In spring, the bowhead and beluga whales proceed up the channels opening up in the Beaufort Sea.

The balance of life in the ocean is fragile. Like the calf of a humpback whale, it looks formidable, but human care is required if the ecosystem is to maintain the balance that preserves its existence.

Student Objectives

After seeing the video program and participating in the pre- and post-viewing activities, students will be able to

1. demonstrate familiarity with the key terms relating to the ecology of the ocean that are listed in the pre-viewing activity and used in the video program
2. label a diagram showing continental shelf, continental slope, and ocean basin
3. discuss the importance of the ocean ecosystem
4. describe the ocean food chain in terms that explain the relationship of sunlight to plankton growth and fish populations

Pre-viewing Activities

1. Tell the class that oceans cover about 70 percent of the surface of the earth. Ask students whether they think all this water is a waste area or whether it is useful to the rest of the world. Encourage them to suggest ways in which oceans affect or support life on land. Then ask them whether any events on land, and especially the activities of humans, can have any effect on something as vast as the oceans. Tell students that the video program will show how the ocean ecosystem interacts with land-based ecosystems. They should notice the many ways in which this interaction occurs.

2. Preview the Alaska ecosystems map (page 57) showing the surrounding bodies of water. Point out to students that Alaska is a peninsula, surrounded by water, and that much of the coastline consists of islands, inlets, and waterways. Such geographic features make the effect of the ocean particularly significant.

3. Introduce the following terms, which are used in the video program. Find out how many are familiar to the students, and tell them to listen for their use in the program. Definitions can be found in the glossary (pages 63–66).

algae	migration	bacteria	microscopic
basin	spawning	continental shelf	plankton
continental slope			

Post-viewing Activities

Questions for Thought and Discussion

1. Display the graphic on page 60 showing a cross-section of the continent, continental shelf, continental slope, and deep sea floor.

   a. Ask students to identify the four areas.

   b. Which is the area where 90 percent of marine life is found? *(continental shelf)*

   c. Why do you suppose life flourishes better there than in other parts of the ocean? *(more nutrients due to run-off from land, warmer water, more light)*

2. How does the ocean influence each of the following conditions on land?

   - weather *(Oceans moderate the temperature. The earth would have much greater extremes of hot and cold if the oceans did not serve as "heat sinks," that is, if they did not absorb heat from the atmosphere when it is hot and release some of that heat back into the atmosphere when it is cold. Fairbanks, Alaska, which is far from the ocean, has hotter summers and colder winters than Anchorage, which is near the ocean.)*
   - water *(Oceans are a crucial part of the water cycle. Evaporation from the oceans forms the moisture-laden clouds that blow over land to release their moisture.)*

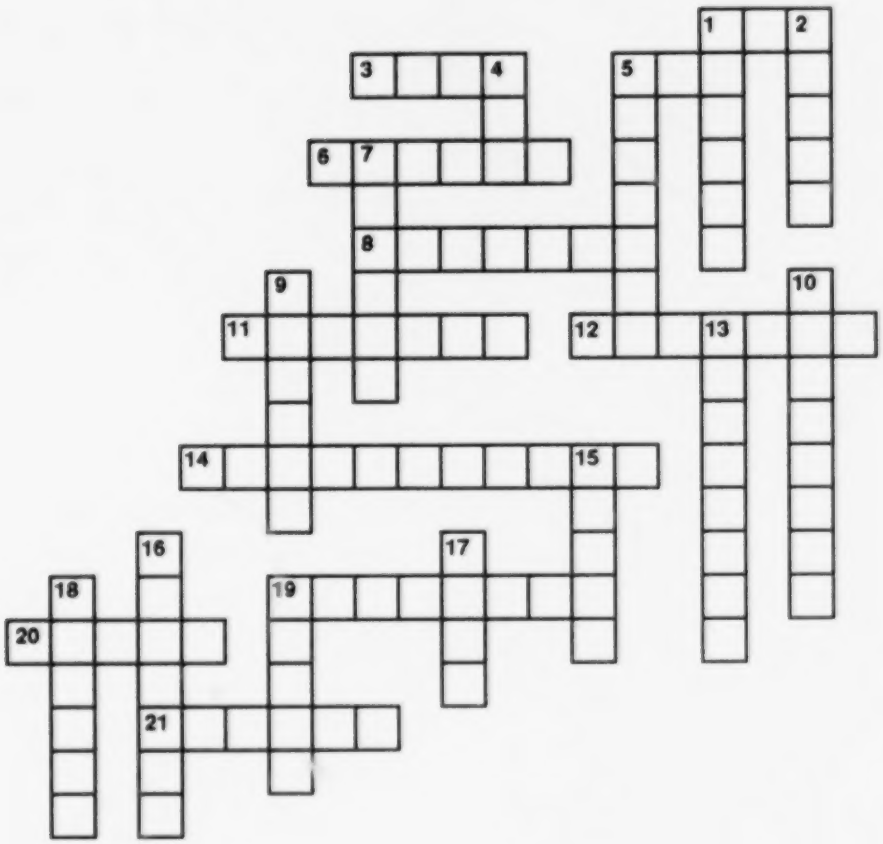
- oxygen *(Phytoplankton, microscopic plants in the ocean, produce 50 percent of the earth's oxygen supply through photosynthesis.)*
- food *(Seafood has long been a staple for coast dwellers. With modern refrigerated shipping, it can be enjoyed inland as well. In addition, seaweed supplies products that are important in food processing, and fish not eaten by humans may be used to produce fish meal, important in livestock production and agriculture.)*
- energy *(A significant amount of the world's petroleum reserves are located under the oceans. The oceans will probably also be a source of alternative energy in the future.)*

3. Why is pollution of the ocean a serious problem? *(The ocean ecosystem is extremely complex and affects all land-based ecosystems. Toxic waste can enter the food chain at the lowest level and have devastating effects on sea mammals, on humans who eat large fish, and on economies based on fishing. An oil spill may kill sea birds. The fallen population of birds may seriously affect a distant ecosystem to which they usually migrate.)*

Deskwork

Directions: Reproduce the crossword puzzle, word scramble, and quiz. Distribute them to students for class work or homework. (Answers to all of these are found page 36.)

Oceans Crossword Puzzle



Across

1. Body of water partly separated from a large body by land; Kachemak for example
3. A short test
5. A portion of an ocean; Bering for example
6. A fish with five species that is important in Alaska
8. The sea close to Kotzebue
11. The largest ocean in the world
12. Northern Eskimo
14. Shelf just off land
19. Small organism important in breaking down wastes
20. The largest mammal
21. The sea around Nome

Down

1. A type of whale that filters Plankton from sea water
2. Western Eskimo
4. Means "animal"; for example, _____ plankton
5. Similar to seal or a walrus
7. Area of mostly tundra
9. Ocean
10. The bay around Homer
13. Microscopic plants and animals in the ocean
15. A single-celled green plant
16. A large fish with unusual eye placement
17. Fur, harbor
18. Good to eat; not large
19. Deep part of the ocean

Oceans Word Search

J G D Q Y M M T R E U E Q J V C N U M X
C R X Q X I O X F U F L H J Z Q M P H G
O Y V C H U K C H I S E A L I O N L A G
N W A L R U S S N F B W H A L E R A L U
T K H V C X F X N Q A K A L I A P N I G
I O F M F S E B W R L K Z R T X U K B L
N J G E M Q U Y P S E O I P B K S T U N
E P W J U I B G S E E M B M F V K O T V
N P A C I F I C E A N D E A C X A N C Y
T U Y K O G K G A D U M A L R G C X E M
A M J S I H U T L B E B U G A F H O E A
L M S J S B A S I N L A F A B X E K Q U
T A H O P E Y F O T L C O E J H M H T M
C R R F U R Y H C R I T R C N B A E I F
H I I A P I A C T S T E T Z G X K R P I
P N M U L N F P O P Q R Z Z S A K T K G
I E P G F G U I P T H I W S A L M O N I
H T A Q I M S Y U P Q A C E R K B S R W
T U U O L D R C S U I H E Z I I A Y V M
D U Q P V C T D F Q A R C T I C Z R G I

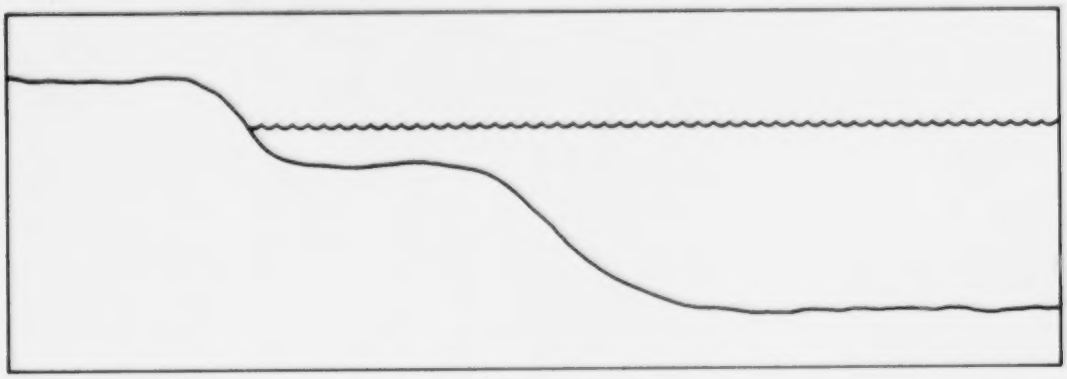
There are 23 words here —can you find them?

Here are the words to look for.

ALGAE
BACTERIA
BASIN
BERING
CONTINENTAL
HALIBUT
MARINE
PACIFIC
SALMON
SEAL
SHRIMP
WHALE
ARCTIC
BALEEN
BEAUFORT
CHUKCHI
CRAB
KACHEMAK
OCTOPUS
PLANKTON
SEA
SEA LION
WALRUS

Oceans Quiz

1. **Label the diagram below to show land, continental shelf, continental slope, and ocean floor.**



2. **List five marine mammals.**

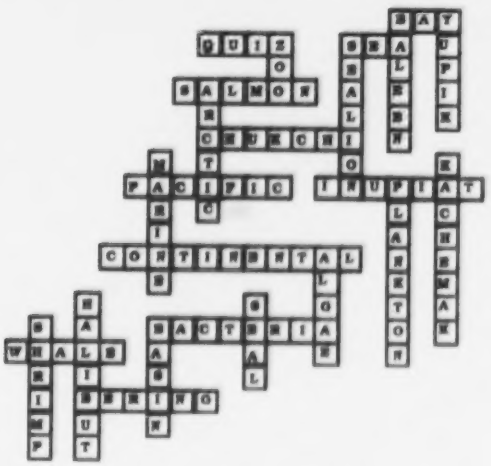
3. **Microscopic plants and animals in the ocean are called**
   a. bacteria
   b. plankton
   c. phytoplankton
   d. zooplankton

4. **The continental shelf is**
   a. the mountainous plateau of Alaska
   b. the bedrock on which a continent stands
   c. shallow submerged area extending out from shore
   d. the ocean floor

5. **Which condition is most important in producing the greatest amount of ocean life?**
   a. warm water
   b. sunlight
   c. cold water
   d. plankton

Answer Key

Oceans Crossword Puzzle



Oceans Word Search

CONTINENTAL
WMARINE
AASHRIMP
CLACI
HRIFBERING
UUSAS
KSICSEALIOCTOPUS
CSCHSEAN
ISEAN
SBALEENNA
EWBACTERIAR
AHBEAUFORTC
LAALGAET
ILCRABAL
OEL
NKACHEMAKM
PLANKTONO
HALIBUTN

Oceans Quiz

1—See map showing cross section of the ocean floor (page 60).

2—*(whale, seal, sea lion, otter, walrus)*

3—b; 4—c; 5—b

Lesson

6 Impact of Human Habitation

Program Summary

Human habitation has brought problems to the "Ecosystems of the Great Land," but there are ways to mitigate some of the negative impact. Although people occupy only one half of one percent of all the land the taiga covers, they can reach every part of this territory. The program shows a float plane flying over the vast expanse of interior taiga. Then another small plane lands on a glacier, demonstrating how people reach even the most inaccessible parts of Alaska.

The program reviews the fragile nature and small carrying capacity of the tundra. How do people survive in this frigid semi-arid region? Salmon, caribou and marine life are all sources of food. Human intervention affects bird habitats, road dust on lichens, and ponding on permafrost.

The taiga is the home to the largest number of Alaskans. The railroad, road systems, military bases, agriculture, and large cities all affect this ecosystem. Moose use railroad beds for trails and forage areas during the winter. The result is that many moose are killed each year by trains.

The coastal forest is the Alaskan ecosystem best able to recover from human intervention because it receives more energy from the sun. Extensive logging affects salmon habitat and has other long-range environmental impacts.

Finally, the program touches on the ocean ecosystem, showing how waste from human civilization can enter the food chain. Halibut sometimes contain high levels of mercury, a toxic heavy metal, which originates from human activity such as mining.

Wise care is needed for the four major ecosystems of Alaska, and for all of the earth's ecosystems. Each is fragile in its own way, regardless of the external appearance. Each needs special care and maintenance to maintain a natural balance.

Student Objectives

After participating in the pre- and post-viewing activities and seeing the video program, students will be able to

1. demonstrate familiarity with the key terms relating to the ecology of the tundra that are listed in the pre-viewing activity and used in the video program

2. list the four major ecosystems of Alaska and three characteristics of each

3. identify and discuss one current resource issue involving each of the four ecosystems

4. state why it is important to be knowledgeable about Alaskan resource issues

Pre-viewing Activities

1. Ask students what kind of ecosystem supports human intervention least well. What do they think defines a *fragile* ecosystem? *(Try to elicit from students that an ecosystem is fragile if it takes a long time to recover from any negative impact. The tundra of Alaska, for example, may require 20 years for new growth to erase the sign of a tire track. Students may also correctly suggest that an ecosystem such as the ocean that provides the foundation for a significant part of the food chain might also be considered very vulnerable.)*

2. Ask students to brainstorm several examples of current issues in which environmental and economic issues appear to be at odds. When, if ever, is it justifiable to sacrifice part of an ecosystem for economic or social reasons? In what ways can the negative impact of human activities be minimized?

3. Review the Alaska ecosystems map (page 57) to identify the four ecosystems.

4. Tell students that they are about to view a program about the four ecosystems of Alaska and the effect of human activity on each. Introduce the following terms and find out how many are familiar to the students. Suggest that they listen for them in the program. Definitions can be found in the glossary (pages 63–66).

clear cutting	population	habitat	pollution
ecosystem	taiga	marine	silt
Haul Road	tundra	permafrost	thermokarsting
ocean	coastal forest	placer mining	toxic waste

Post-viewing Activities

Questions for Thought and Discussion

Directions: The following questions may be used either in group discussion or as individual assignments. Some of the questions are complex and require higher order thinking skills, and the result will be divergent answers.

1. What are the four ecosystems of Alaska? *(tundra, taiga, coastal forest, and ocean.)*

2. What are two characteristics of each of the four ecosystems? *(The tundra is cold, above or beyond the tree line, underlaid with permafrost. The taiga has large stands of spruce and birch, it is relatively dry, and fills an intermediate position between the tundra and*

coastal forest ecosystems. The coastal forest has abundant precipitation, a mild climate, and a great variety of living things. The ocean ecosystem features saltwater, more light at the surface, warm and cold currents.)

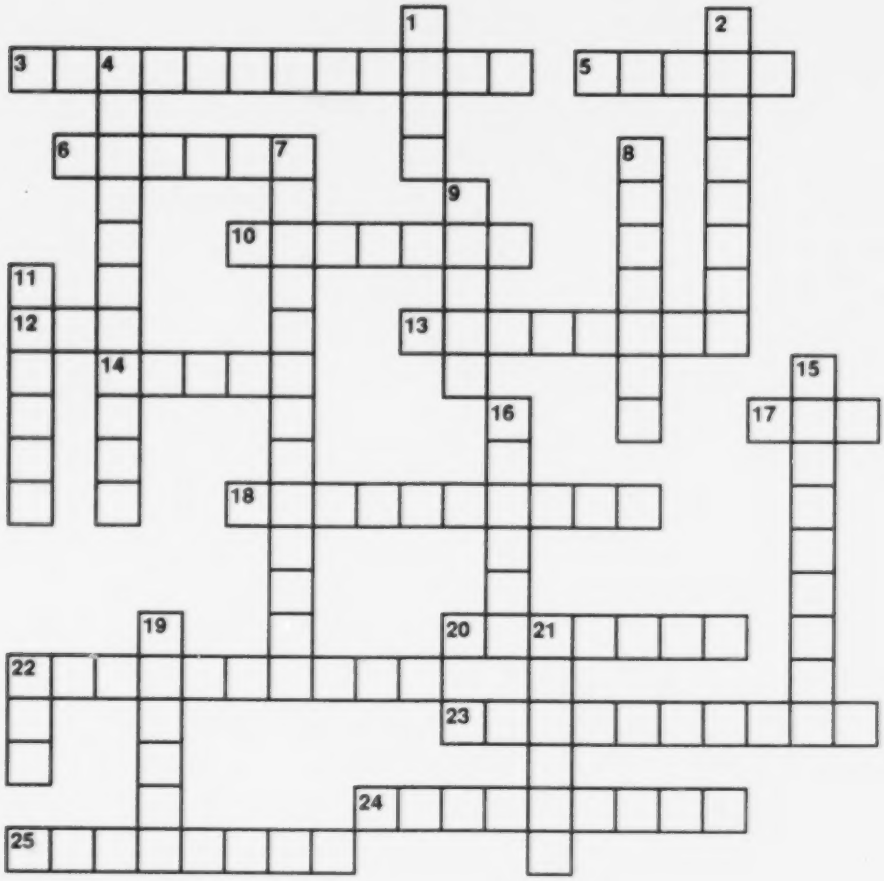
3. List at least one resource issue that involves each of the four ecosystems. *(Answers will vary. For example, the tundra is threatened by oil development, Red Dog Mine, Haul Road, subsistence hunters. The taiga is threatened by toxic waste, sewage disposal, air pollution, and wolf hunting. The coastal forest is affected by clear-cutting and mining. The ocean is harmed by over-fishing, dumping of hazardous materials, and whaling.)*

4. If you held a high political office (president, governor, secretary of the interior) and had a limited budget for environmental protection, what do you think is the most important ecosystem to try to protect, and why? *(Answers will vary. Ideally, students should be eager to protect* all *ecosystems and reluctant to make choices. They could argue legitimately for protecting the ocean because of its impact on humans through the food chain. They could also argue for protection of the tundra or taiga because of their extreme fragility. Some students may argue for protection of the coastal forests because of their importance in Alaskan economy. The choice students make is not as important as their arguments in support of it.)*

Deskwork

Directions: Reproduce the crossword puzzle, word scramble, and quiz. Distribute them to students for class work or homework. (Answers to all of these are found on page 43.)

Impact of Human Habitation Crossword Puzzle



Across

3. Mining by using water pressure
5. Large body of water
6. Northernmost part of Alaska
10. Large fish with unusual eye placement
12. Black gold
13. One of the major transportation forms in interior Alaska
14. The ecosystem around Anchorage and Fairbanks
17. Red or arctic
18. Chemical hazardous to our health
20. Close relative of reindeer
22. The number of people or animals
23. A mine under development north of Kotzebue
24. The largest city in Alaska
25. Forest area where all the trees have been cut

Down

1. Soil suspended in water
2. The road from Fairbanks to the North Slope
4. Farming
7. The ecosystem around Juneau
8. The study of the home
9. The species that has the greatest impact on the ecosystem
11. Toxic
15. Air and water are two types: the results of careless use of resources
16. The largest state in the USA
19. The ecosystem of the far north
21. The mine by Cape Krustenstern
22. A highly toxic chemical found in old transformers

Impact of Human Habitation Word Search

C R N P T L F T J K J G D Q Y M M T R E
O U E Q J V C N U M X R X Q X I O P R X
A F U H A U L R O A D F L H J Z Q O A M
S C A R I B O U T A I G A O I L G P I Y
T V G S N F R U K H V H P C X F X U L N
A Q K A L I A P G O F U L M F S A L R E
L B W R K Z R T X U L M A J G E G A O M
F Q U Y P O I P B K S A C N P W R T A J
O R E D D O G M I N E N E S U I I I D B
R G M M F V V D X C Y T R I U Y C O K O
E G K G D U M G X E M O M L M J U N S I
S A P H U T O C E A N X I T T B L E F O
T R O E A U J S E L X I N K Q U T T O P
Y C I F T N L J C H H C I T M C U F U Y
H T S R I D C N O B E W N I F H R A P A
C I O S T R Z G L X R A G P I P E U L F
P C N P Q A Z Z O S A S K A L A S K A T
K G I G F U I T G H W T I H T A Q I M S
Y P Q C E R K B Y S R E W T U U O L D R
C U I H E Z I I A H A L I B U T Y V M D

There are 20 words here —can you find them?

Here are the words to look for.

AGRICULTURE
ARCTIC
COASTAL FOREST
HALIBUT
HUMAN
OIL
POISON
RAILROAD
SILT
TOXIC WASTE
ALASKA
CARIBOU
ECOLOGY
HAUL ROAD
OCEAN
PLACER MINING
POPULATION
RED DOG MINE
TAIGA
TUNDRA

Impact of Human Habitation Quiz

1. **The four ecosystems of Alaska are**
   a. tundra, taiga, savannah, lakes
   b. glacier, rain forest, lakes, rivers
   c. tundra, taiga, glacier, coastal forest
   d. ocean, coastal forest, taiga, tundra

2. **Which Alaskan ecosystem receives the least amount of energy from the sun and is therefore most fragile?**
   a. coastal forest
   b. tundra
   c. savannah
   d. taiga

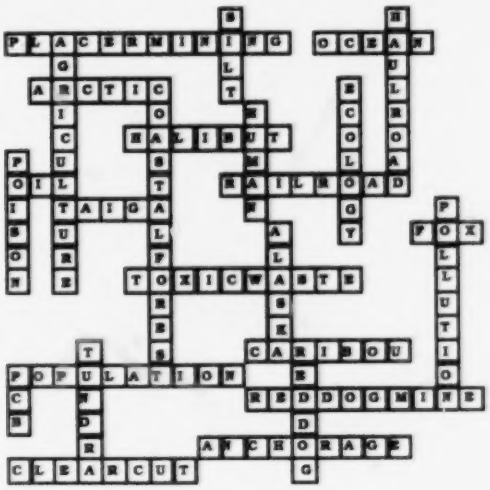
3. **The greatest threat to the coastal forest ecosystem is**
   a. salmon fishing
   b. building of cities
   c. clear-cut logging
   d. bear hunting

4. **The ocean ecosystem is important to humans because**
   a. the whaling industry is economically important
   b. it is the foundation of an important food chain
   c. it is a source of salt
   d. storms can damage shorelines

5. **The Alaskan ecosystems**
   a. are independent of other ecosystems
   b. are affected by the neighboring ecosystems
   c. combine to form one large ecosystem that is independent of other ecosystems on the earth
   d. are interdependent with all the earth's ecosystems

Answer Key

Impact of Human Habitation Crossword Puzzle



Impact of Human Habitation Word Search

```
COASTALFOREST
.....
.....
.CARCTIC
.....
.....
.....
```

Extended Activities

1. The Web of Life

Process: field techniques, scientific method
Concepts: web of life, food chain, ecosystem

Identify a local ecosystem. A marsh or pond, a neglected field, or a woodland would offer rich possibilities. Arrange a field trip to the area to research and inventory as many plants, animals, decomposers, and nonliving (abiotic) things in the chosen environment. (Small groups of students might each be assigned a quadrant about one meter square. Include carnivores, herbivores, insects, birds, mushrooms, bacteria, trees, soil, water, and air. List the inventory on the board or give each student a copy.

(Note: Many field guides to the trees, plants, fungi, insects, birds, and animals of different areas exist and are readily available in libraries. You may also find it useful to refer to *A Field Guide to Your Own Back Yard* by John Hanson Mitchell. The complete reference is in the resource section.)

Help students identify what each item on the list eats or needs to survive, and how other things use it for their survival. Where there is uncertainty or lack of knowledge about the function of a listed item, students should be assigned to research the subject.

Concept Mapping

Then provide students with large sheets of paper (newsprint would be ideal). Have them copy the list of items on the board onto the paper, placing the words randomly across the whole sheet of paper and roughly equally spaced. Then have them draw lines connecting each word with the words of the objects that the item depends on or that depend on it. Double lines might indicate mutual dependency. *Rabbit* might be connected to *willow*, *grass*, *soil*, *sun*, and *water* by a double line, and to *fox* by a single line.

When the web is completed, call students' attention to its complexity. Suggest that they isolate one item and imagine its removal from the web. (They could cover the word with a small piece of paper.) Have them note which items would be left "dangling" without connection. What then happens to the rest of the web? In what ways is the model similar to, and dissimilar to, the web that exists in real life?

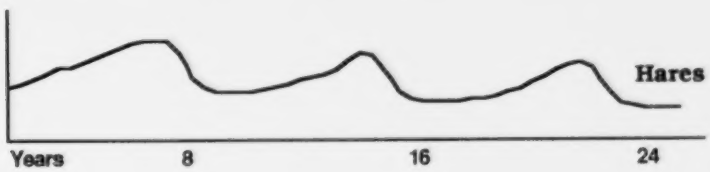
Hypothesis and Experiment

Have students, individually and in small groups, choose two organisms from the web and hypothesize their relationship. Encourage them to devise an experiment to test their hypothesis.

2. Willow, Hare, and Lynx

Process: analyzing graphs, scientific method
Concepts: predator-prey relationships, interdependency, homeostasis, dynamic equilibrium

For a hundred years, the Hudson Bay Company commissioned North American trappers to trap hare and lynx for the fur markets of Europe. The company kept records of the numbers of pelts shipped each year. Researchers studying those old records found that the hare population peaks every seven to nine years, then drops dramatically. Graphed, the hare population looks something like this.



Researchers also found that the lynx population does the same thing, except that their population peaks one year after the hares'.

Have students draw on the information and graphs above to discuss or write on the following questions.

1. Why is there a one-year gap between the time the hares' population is at its lowest and the time that the lynx's population is at its lowest? *(During the year when the hare population is falling, the lynx still have plenty of hares to eat. It isn't until the following year, when many of the hares are dead, that the lynx feel the pinch.)*

2. Do the lynx control the hares, or do the hares control the lynx? *(The latter. We have been brought up to "know" that predators control the prey, and are now discovering that it's the other way around. The number of prey animals available tell us how many predators can live in an area.)*

3. Speculate on reasons for the decline in hare population and then its recovery. *(Accept all answers which develop a hypothesis based on the hares' food supply and its periodic unavailability. Developing a hypothesis for the recovery of the hare population will be more difficult, but encourage speculation.)*

4. Discuss the "balance of nature." Is nature ever in perfect "balance?" *(Not exactly. There is constant fluctuation, but over several cycles of years the same relationships tend to hold.)*

After students have answered these questions to the best of their abilities, tell them the reason for the cycles in hare population. Few of them would have guessed it.

> Research has found that the major food of the hare is a small willow. As hare populations grow, the willows get nibbled back. When the willow plant has be "hedged" or eaten back so far, the plant generates a toxin which makes it inedible for the hares. That's when the hare population crashes, followed about a year later by the crash of the lynx. The willow, relieved of pressure, then begins to grow again. The hare population begins to grow in response, and finally, within a year or so, so does the lynx population. And the cycle has begun again, as it does every seven to nine years—over and over.

3. Water Games

A. Where in the World is Water?

Process: demonstration, visualization of proportions
Concepts: water supply and storage

Bring measuring cups, measuring spoons, and two five-gallon pails to class. Fill one pail with water. The other should be empty. Tell the students that the full pail represents the Earth's total water supply, including all water found underground and in the atmosphere as well as the Earth's surface.

Ask students how much water they think should be removed from the full bucket to represent all the water found in lakes. Call on a student volunteer to transfer the amount guessed from the full bucket to the empty one. Poll the rest of the students. How many would have transferred more water? Less? About the same amount?

Continue this process, with different water sources and different volunteers, until all of the water has been transferred. Then demonstrate to students the correct amounts listed below.*

If the world's water were in a five-gallon pail...

- oceans—all but 2-1/4 cups (i.e., 4 gallons + 3 quarts + 1-3/4 cups)
- glaciers and ice caps—a little more than 1-3/4 cups
- ground water—a little less than 1/2 cup
- lakes—a little more than 1/2 teaspoon
- soil moisture—a little less than 1/8 teaspoon
- water in atmosphere—1/100 of a tablespoon
- rivers—1/1000 of a tablespoon

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* Calculated from G. Tyler Miller, *Living in the Environment* (2nd ed.), Wadsworth Publishing Company, Belmont, CA, 1979, p. 338.

B. The Long Life of a Drop of Water

Process: discussion, scientific method
Concepts: renewal rate, water cycle, global weather patterns

Remind students that the Earth's water is contained in the sources listed in the left column below.

Ocean	3,100 years (37,000 for deep ocean water)
Ice Caps and Glaciers	16,000 years
Atmosphere	9–12 days
Lakes	10–100 years (depending on the lake's depth)
Rivers	12–20 days
Soil Moisture	280 days
Ground Water (up to 1,000 meters deep)	300 years
Ground Water (deeper than 1,000 meters)	4,600 years

Tell them that the water in each of these renews itself at very different rates. As discussion or as a written exercise, ask them to rank the sources from fastest to renew itself to slowest, and to give reasons for their answers. You might also ask them to hypothesize on the length of each renewal cycle. Then share the data from the column on the right. Discuss reasons for the great variety in rates.

Show students a small amount of water in a container. Tell them that the water they see consists of drops that might once have bathed Helen of Troy (or Julius Caesar, Napoleon, George Washington, or whomever you choose). Ask students to speculate about the steps in the movement of those water molecules from that ancient bath water to the container you hold in your hand. Have them draw a picture or diagram tracing the path of the water molecule, keeping in mind the renewal rates for different sources of water.

4. The Legislative Process: Influencing the Decision Makers

Process: legislative action, research, writing
Concept: political process, environmental issues

Note: This activity requires the teacher to do a lot of focusing and directing of students. It is ideal as an interdisciplinary activity involving science, social studies, and English (writing) classes. After studying the ecological issues in Alaska, students may want want to get involved in some current environmental issue.

Have the class discuss how to contact a representative to your state or provincial legislature. Find out from the representative which environmental issues may result in proposed legislation. Some issues might

involve waste disposal, wilderness areas, water development, or conservation. Legislative affairs offices, environmental groups, public conservation authorities, wildlife services, and citizens' research and lobbying groups (League of Women Voters, Public Research Groups) may also have information.

Help the class gather information on the issues addressed in the bills under consideration. Students should decide which bill interests them the most, either to lobby for its passage or work for its defeat. They should then get a copy of the proposed bill.

Assign different students, or small groups of students, to study different sections of the bill. The interpretations of each section should be reported back to the class.

Assign research tasks on the issues addressed in each section of the bill. Students should be encouraged to solicit information and analyses from people and organizations knowledgeable about the issue.

You or the class should decide whether to arrive at a consensus and have the whole class act together, or have groups or single students take different stands on the issue. If the class works as a whole, it should write a position paper, drawing on the information it has gathered. Each student should write a letter to a different legislator, preferably those on the committee that will be dealing with the bill. Students should be encouraged to write their letters from as personal and compelling a perspective as they can. Each letter should be accompanied by the position paper, if the class has written one.

Depending on students' interest in the project, they could then be encouraged to carry their campaign into the community, writing letters to the newspaper and soliciting the support of other groups and individuals.

Students should be assigned to keep track of the movement of the bill through the legislature. When an important vote is pending, they should be prepared to mobilize with more letters or phone calls. They might establish a phone tree to alert community allies.

When the results are in, let students celebrate if their side prevailed. If not, encourage them to try again at the next session, and in the meantime they can work to elect legislators sympathetic to their point of view.

5. Animals in Oil

Process: scientific method, experimentation, writing lab reports
Concepts: surface tension, buoyancy, environmental impact, thermal insulation

Oil spills can happen wherever oil is handled, transported, processed, stored, or extracted from the earth. The effects on wildlife range from direct kills (fish, birds, shellfish, and plants) to reducing the reproductive ability of organisms.

Experiment

Have students in groups prepare 3 packets consisting of aluminum screening pieces each 5 x 3 cm (2 x 1-1/2 inches), stacked in groups of four layers, each piece at right angles (screening alternating direction) to the one below it, and each stack of four stapled together.

Provide feathers and hand lenses so students can examine the little "windows" of light through the feathers. Explain that feathers are similar to the screening stacks. On a bird, feathers are layered one on top of another, just as the pieces of screen are. Layers of feathers trap numerous little air spaces that hold in the bird's body warmth and keep out cold water.

Have students fill three small bowls with water. The first bowl remains untouched. In the second they should add about a tablespoon of motor oil and stir. To the third bowl they should add about 1/2 teaspoon dishwashing detergent and mix it in. (Caution: students should perform these tasks carefully and in order, to avoid contaminating the plain water bowl or the screen pack.)

One stack of screening should be laid on each of the three bowls. The one laid on the water bowl will float if it has been laid carefully and flat. It should remain floating. The screen on the second bowl (oil in the water) will also float, but students should be able to observe the oil slowly bubbling up through the layers of screen to the upper surface. The screen on the third bowl with detergent will sink immediately.

Have students remove the first screen very carefully, keeping it flat. If they run a clean, dry finger across the upper surface, they should be able to observe that it is dry. The upper surface of the second pack should feel oily to them.

Challenge students to remove the third screen from the detergent solution, shake it dry, and make it float in the plain water. They will be unable to do this.

Lab Report

Have students write *in detail* the results of their experiment.

Explanation

First ask students to explain the results if they can. Encourage them to generate as many plausible hypotheses as they can. Can they devise any additional experiments to test their hypotheses?

If they have the background, students will point out that this experiment demonstrates the effect of surface tension of water and the importance of the buoyancy created by the airspaces in the screening. The screening in clear water floated, and the surface remained dry, because each small space between the wires of the grid contained air. The pockets of air, being lighter than water, helped the screen float. In addition, the air pockets and screening wires combined to make a continuous, unbroken surface across the bottom of the screen packet. It floated as a board would float.

When oil is added to the water, it penetrates the screening, forcing the air out. Because oil is less dense than water, it rises up, breaking the surface tension of the water from below.and cutting through any water clinging to the wires. Then it can fill each air space. The screening filled with oil will not sink, because oil floats on water, but it will be submerged, because oil is denser than air.

The detergent in the third bowl is chemically formulated to cut the surface tension of water. (Many detergents list "surfectants" as important ingredients.) They do this to permit dirt to lift off wet objects and float away. These same chemicals cut the surface tension of water around each wire of the screening and permit soapy water to enter each airspace, forcing out the air. The screen packet sinks. Even when it is shaken dry, detergent residue clings to the screening, so it will continue to sink, even in clear water.

Implications

Ask students to describe in detail the implications of the experiment for waterfowl.

The screening simulated the action of a waterfowl's feathers. Birds stay dry (and warm) next to their skin because their feathers, like the screening in clear water, insulate and keep the water out. When their feathers are soaked with oil, they will still float, but much less easily, and their extra weight will make it difficult for them to fly. If the oil is cleaned with detergent, there is real danger that detergent residue on their feathers would cause them to sink immediately. Even if they stay afloat, the water penetrating through their feathers may chill them fatally. Cleaning birds caught in oil spill requires real knowledge, experience, and care.

6. Habitat Game

Process: experiencing wolf and moose relationships and demographics, analyzing data
Concepts: predator-prey relationships, carrying capacity

This game may be played by a group if the playing board (shown on page 53) is projected on a screen by an overhead projector. Otherwise, you might enlarge the playing board using a photocopier, glue it to a sheet of cardboard, and cut it out.

Photocopy and cut out the counters on page 54. Glue each "Habitat" counter to a piece of cardboard, turn it over, and glue a "Wolf" or "Moose" counter to the opposite side. You will also need a standard die.

The purpose of the game is to show the relationship between predators and prey in a habitat. The game needs to be played repeatedly in rounds (by different classes on the same day, or the same class over several days) and the results of each round recorded. Each round should start with players using the same number of wolves, moose, and habitat support counters that remained at the end of the previous round. Ten rounds should provide enough data for making valid conclusions.

To Begin

Place two counters marked "Wolf" in the center of the circle. Place eight "Moose" counters in spaces on the outermost ring of the playing board. Randomly scatter 10 counters with the "habitat" side up in the spaces in the three rings.

Goal

The moose are trying to move to the inner ring and back out to the outside, gaining support from their habitat and avoiding wolves as they do so. The wolves are trying to catch a moose as they move to the outer ring and back to their den. Each time a moose "captures" a habitat counter, the habitat counter become a moose. (In other words, the moose multiply.) Turn the habitat counter over; it will be labeled "moose" on its other side.

Each time a wolf captures a moose, the wolves multiply. Place a "wolf" counter on top of the captured moose counter. If a wolf goes to the outside ring and returns to its den without having captured a moose, it dies. Its body returns to the earth, nourishing the habitat. (Turn over the wolf counter so that the "habitat" side is uppermost. Place it on any space, preferably those that are empty.)

Playing Procedure

All moose move first, then all wolves. Each move is governed by a roll of the die. Players may move sideward, forward, or diagonally forward, but they may never move backward. Movements are governed by the numbers on the die.

1—no move; stay in place

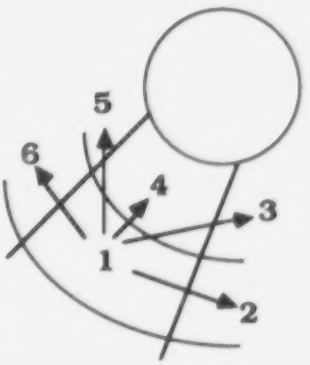
2—move to right in same ring

3—move forward and to the right

4—move directly ahead

5—move forward and to the left

6—move to the left in the same ring



Moose may share space with other moose, and wolves with both habitat counters and with other wolves. Any other cohabitation involves either the capture of the habitat counter by the moose or of the moose by the wolf. When a habitat is captured by a moose, it becomes a moose moving in the same direction as the moose that captured it (but with a separate throw of the die). Similarly, captured moose become wolves moving in the same direction as the capturing wolf. Wolves who "die" become habitat counters placed on any space in the innermost ring.

The game is over when all the surviving moose have returned to spaces on the outside circle (they can share them), and all the wolves have returned to their den.

Recording

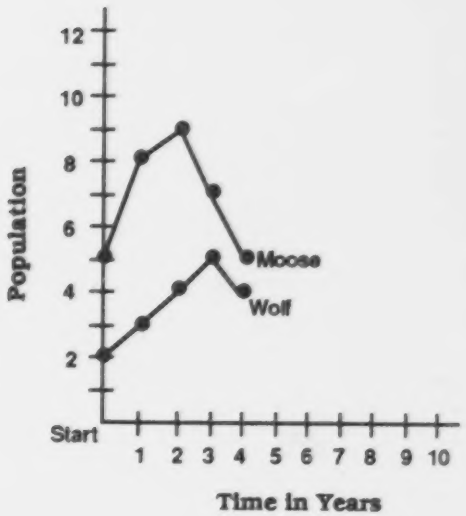
Each round of the game represents one year. Record the number of moose and wolves left at the end of each round, and begin the next round with that number. When 10 rounds have been completed, make a line graph showing the rise and fall in the population of each animal.

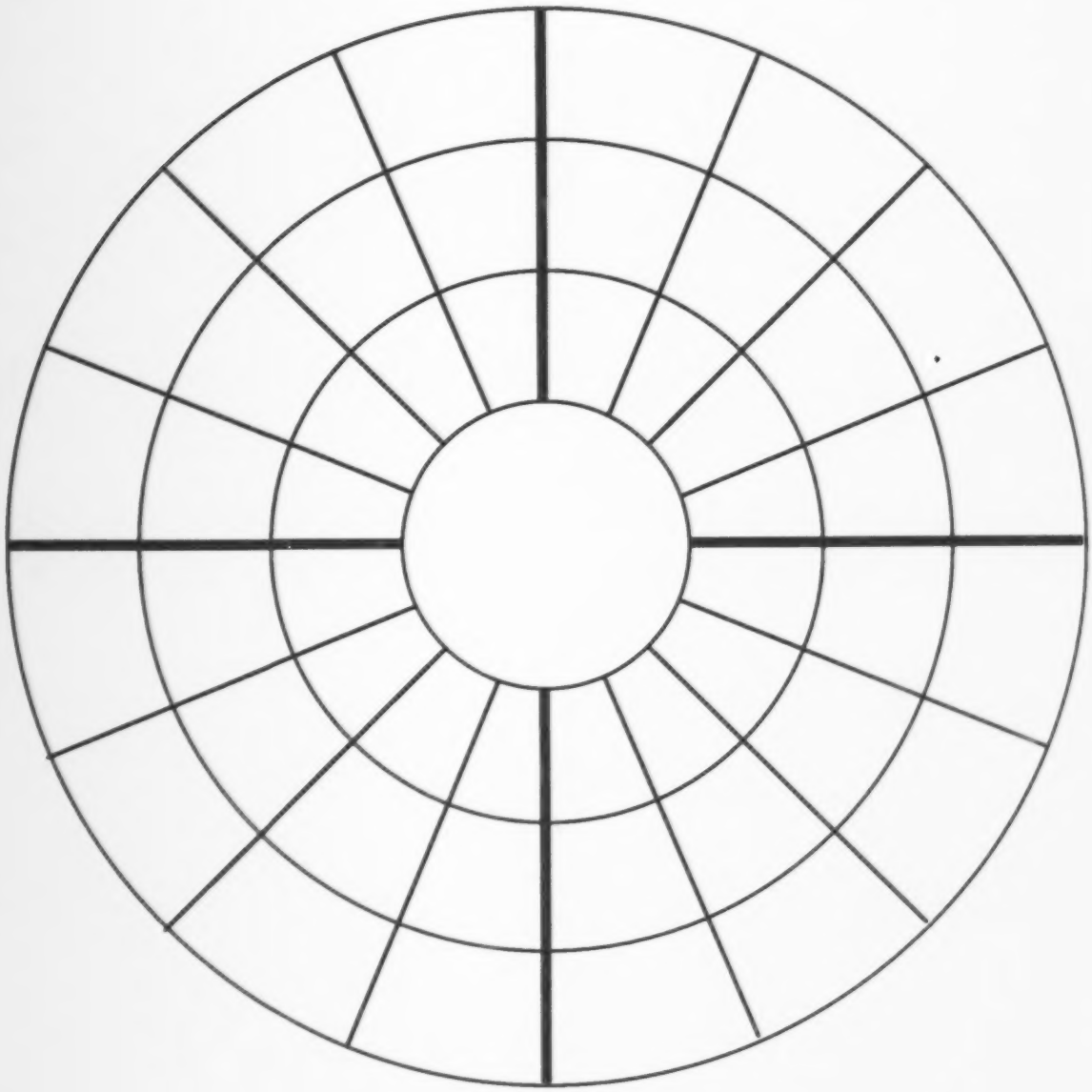
Sample

Chart

Round	Moose	Wolf
Start	5	2
1	8	3
2	9	4
3	7	5
4	5	4

Line Graph





Habitat Game Playing Board

Habitat Game Counter Pieces

7. Pyramid of Life

Process: visualizing the food chain
Concepts: food chain, toxins in the environment

Assemble building blocks, preferably of different sizes and colors. Tell the class that the smallest blocks represent plants in a habitat. The next size blocks represent herbivores, which eat plants. The largest block is a carnivore, which eats the herbivores.

Challenge the class to guess how many "plants" are required to support enough "herbivores" to support one "carnivore." Then have them construct a pyramid with the blocks to test their guesses.

The number of blocks at the bottom and middle layer will vary depending on their size, but the resulting model will always be pyramidal in shape. Discuss this model as representative of a food chain in nature.

To extend the activity, discuss the fact that pesticides and heavy metals become concentrated in the bodies of the higher order carnivores. Why?

8. Living in an Ecosystem

Process: habitat analysis, creative thinking
Concepts: habitat, adaptation, carrying capacity, human impacts

Any living creature has to have a source of food or nourishment, a source of water or moisture, shelter from excesses of heat, cold, or other climactic conditions, and protection from enemies or predators. Humans are more complex than mosses and lichens, but they must still find ways of meeting these basic needs.

Tell the class that they have been caught in a time and space warp. Small groups of them suddenly find themselves alone in the tundra, taiga, or coastal forest ecosystem at a time in prehistory when modern transportation and communication does not exist. What adaptations can they make to meet their needs and survive? Does the animal and plant life in each ecosystem offer clues for survival techniques?

Ask students, individually or in small groups, to choose the ecosystem in which they have found themselves, and to describe, in a poster display, oral report, or essay illustrated with drawings and diagrams, the adaptations they would make for survival.

When students have completed their reports, have them evaluate each other's according to how well they answer the following questions:

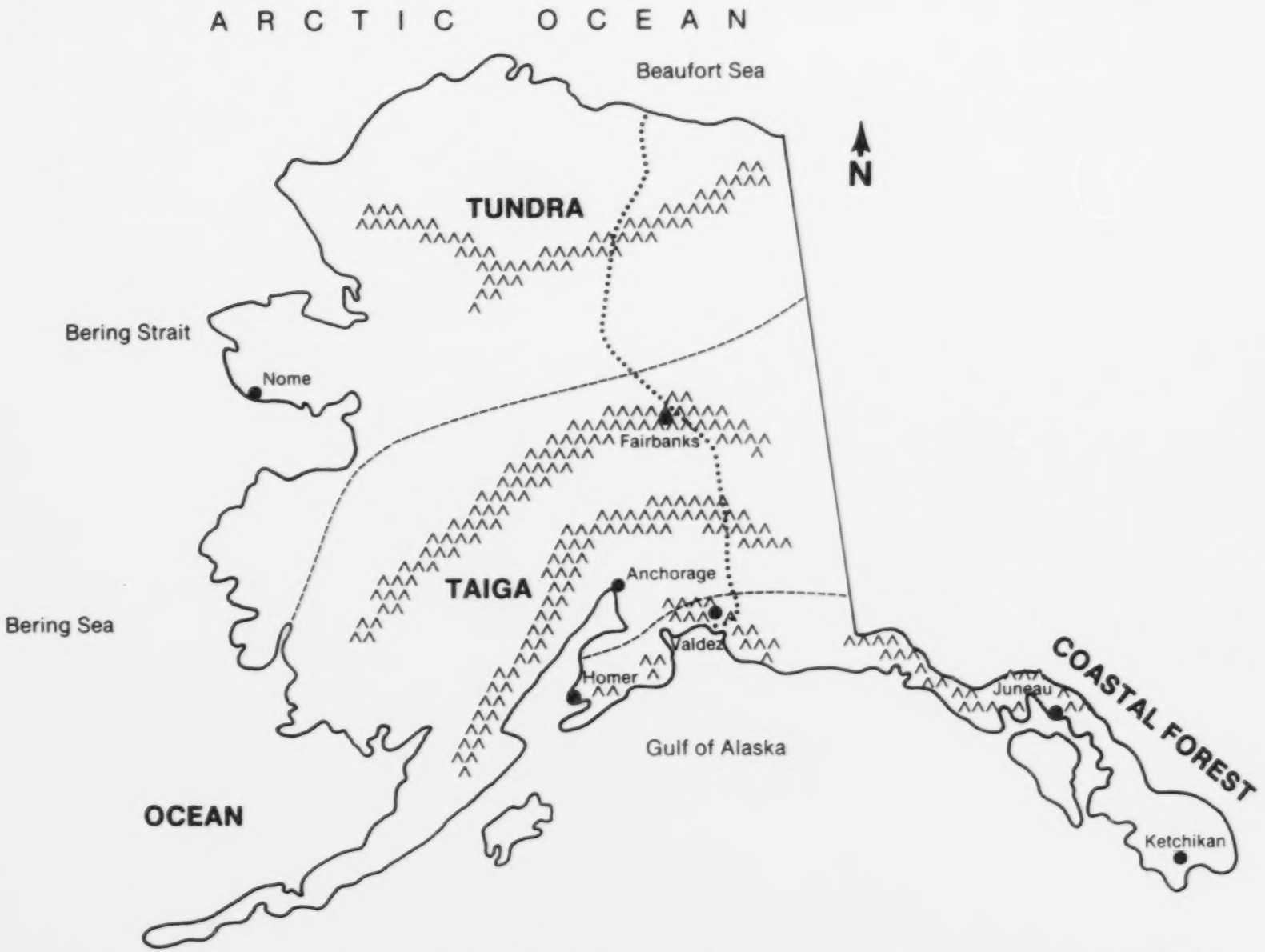
What are some likely sources of food? Is this food always available? Is processing or storage of the food necessary to preserve it for lean periods? How can this food be obtained? What weapons or tools are necessary and where and how can these be obtained? How can it be cooked? What fuel is available?

What materials are available for shelter? (Shelter means both clothing and housing.) What climactic conditions are being considered—rain? wind? extreme cold? What sort of foundation does the house have? What sort of shape and structure? Is there a source of heat? How is fuel obtained? How is energy efficiency assured?

Is there danger from any predators in the ecosystem? How is protection from them assured? What is the effect of all these adaptations on the chosen ecosystem? Do human adaptations threaten to upset the balance of ecosystem?

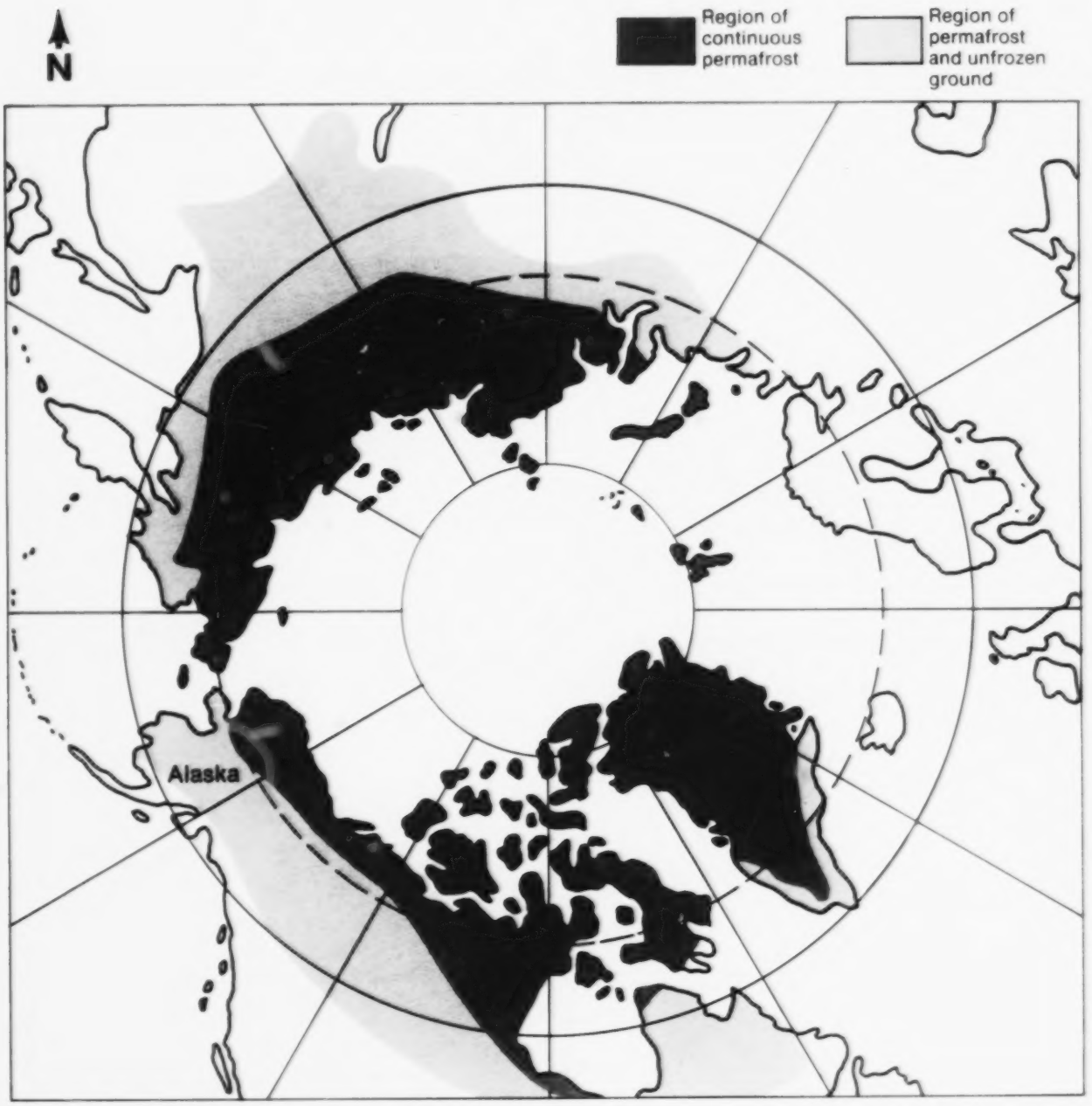
Then have the class as a whole discuss the following questions: How could the proposed adaptations be improved? Are there some ecosystems in which harmless human adaptation is nearly impossible? How would the evaluation change if the same adaptation were made by hundreds of people together in an area, instead of just a small group?

ALASKA ECOSYSTEMS



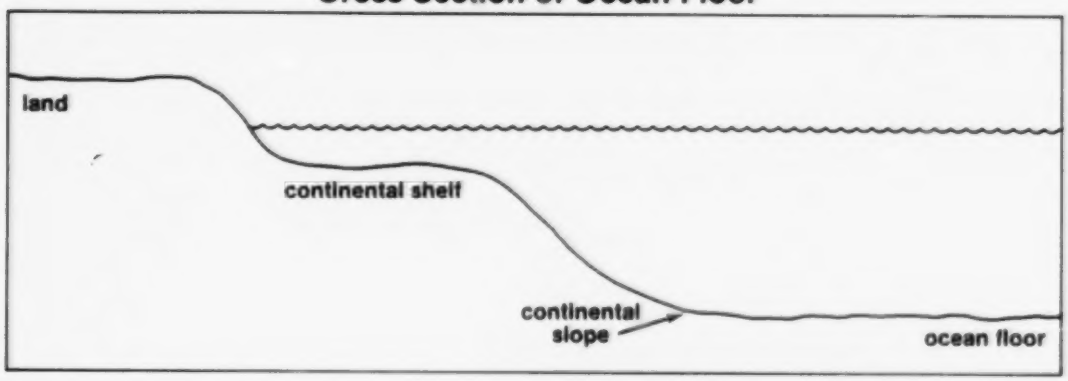
ALASKA ECOSYSTEMS

CIRCUMPOLAR MAP

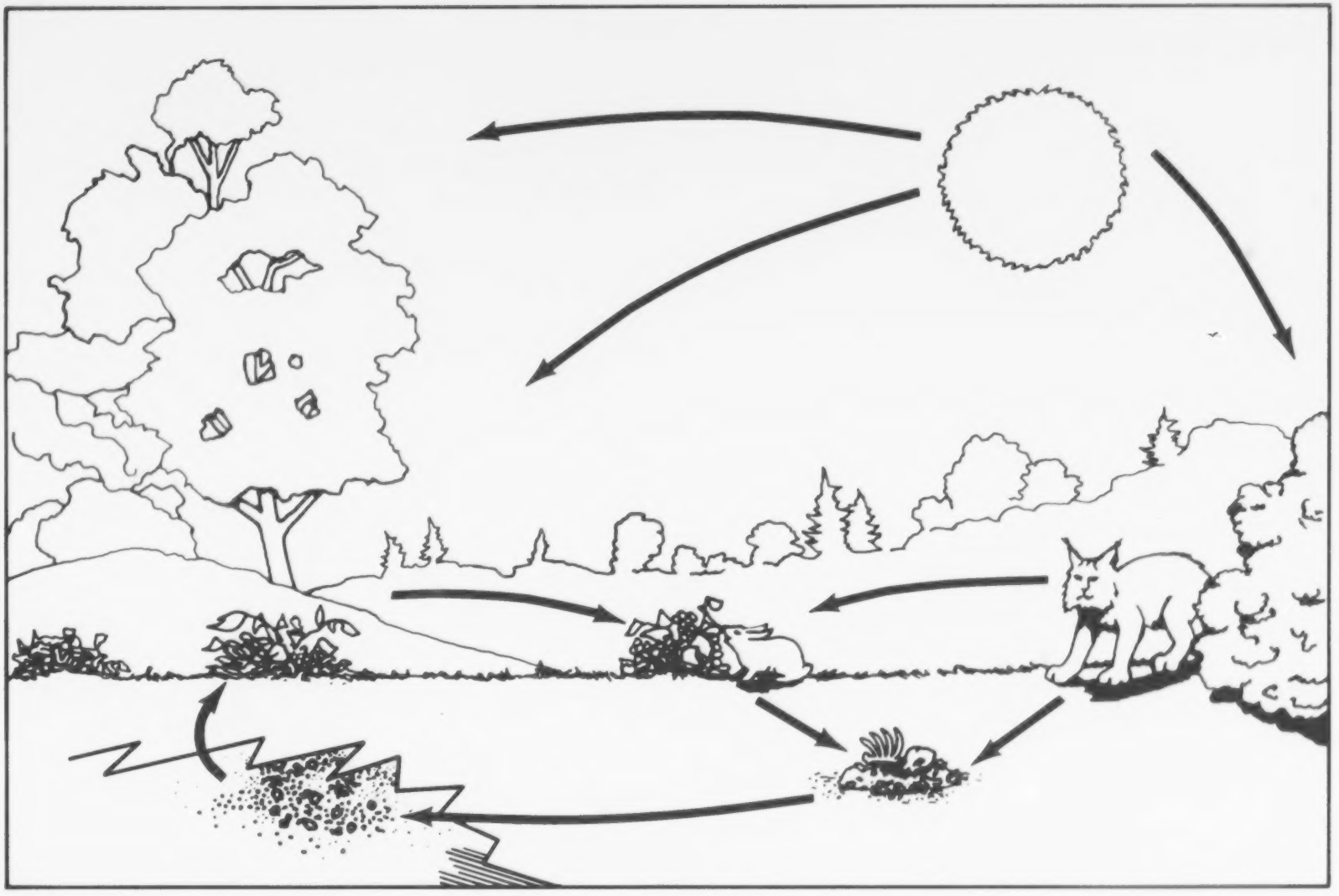


OCEAN FLOOR

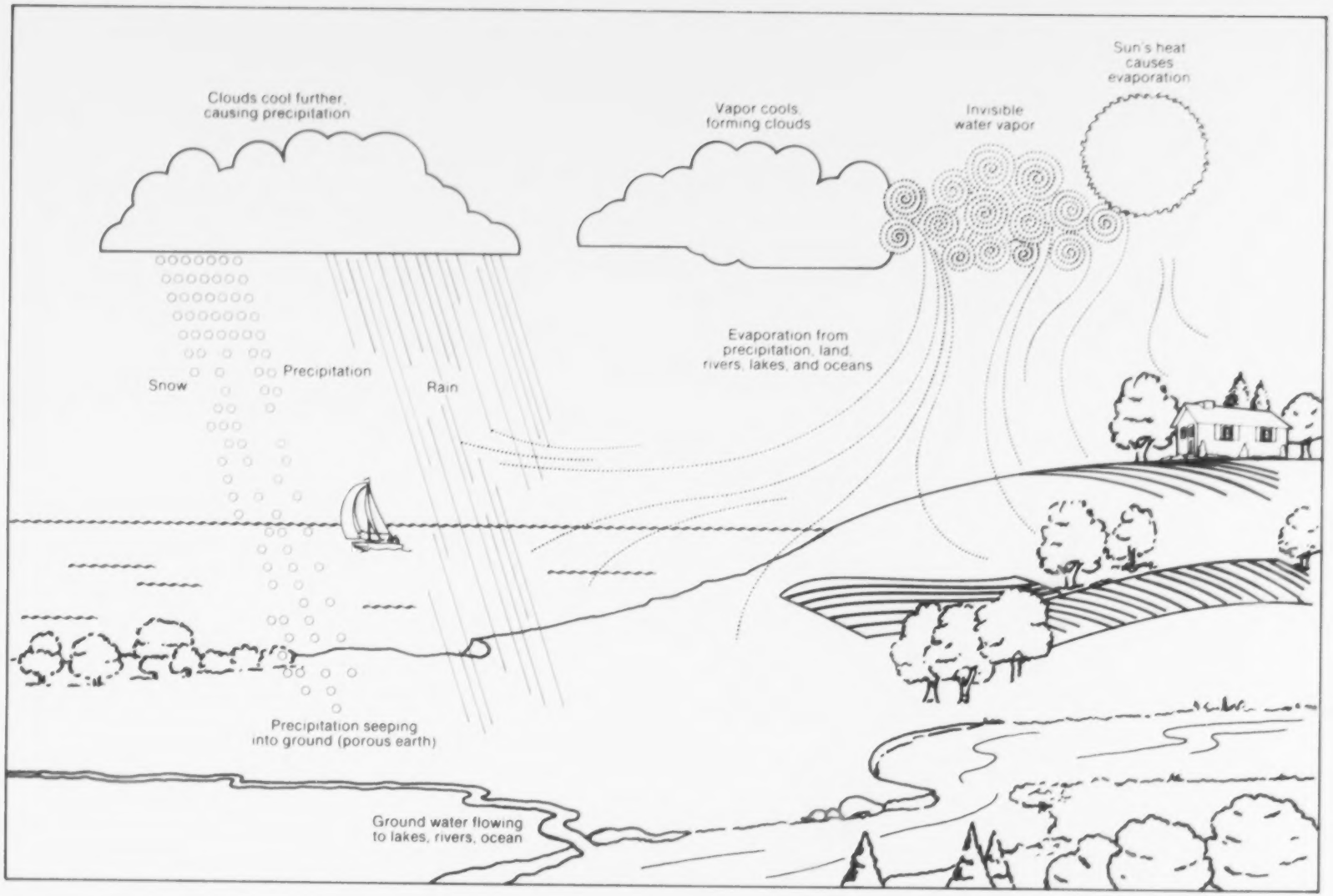
Cross Section of Ocean Floor



FOOD CHAIN



THE WATER CYCLE


Clouds cool further, causing precipitation
Vapor cools, forming clouds
Invisible water vapor
Sun's heat causes evaporation
Evaporation from precipitation, land, rivers, lakes, and oceans
Snow
Precipitation
Rain
Precipitation seeping into ground (porous earth)
Ground water flowing to lakes, rivers, ocean

Glossary

adaptation A change in structure or behavior that increases a plant or animal's ability to live in a particular environment.

algae Single-celled green plants.

arctic That part of the earth above the arctic circle which is the line that defines where the sun does not set at the summer solstice.

atmosphere The envelope of air that surrounds the earth.

bacteria Single-celled organisms important in decomposition.

basin A bowl-like depression in the floor of the ocean.

carbon dioxide The compound CO_2. Plants take in carbon dioxide and release oxygen in the process of photosynthesis. Animals use the oxygen to produce carbon dioxide.

carrying capacity The number of a particular species that a given area of habitat can support with adequate food, water, and shelter.

chain A series of things linked, connected, or associated together such as the food chain.

circumpolar The area surrounding the North and South Poles.

climax vegetation A relatively stable ecological stage or community; the final stage of ecological succession.

clear-cutting A logging practice in which all the trees in an area are harvested at the same time.

coastal forest The rain forest found from southeast Alaska around the Gulf coast to Kodiak Island.

community A group of plant and animal species living together and having close interactions, especially through food chains.

condensation A physical change to a denser form, as from steam to water.

conifer A tree that bears its seeds in cones.

continental shelf The shallow ocean close to shoreline.

continental slope	The sloped area of the ocean floor between the shelf and basin.
cycle	A way to show the relationship between things where there is no beginning or end, such as the water cycle.
ecology	From Greek, meaning "the study of the home"; also, the study of the relationships among living things and the physical environment.
ecosystem	All living and non-living things in an area, linked together by nutrient and energy flow.
evaporation	The process by which water turns to vapor.
habitat	The place where an animal lives that provides food, water, shelter, and space.
Haul Road	The road from Fairbanks to the North Slope oil fields, also know as the Dalton Highway.
hibernate	To spend the winter in a dormant state in which the body metabolism is greatly reduced.
insect	An animal with six legs.
Inupiat	Eskimo people from arctic and northwestern Alaska.
latitude	Distance north or south of the equator.
lichen	Fungus and algae growing together in a relationship that is mutually beneficial.
marine	An adjective that means "ocean."
microscopic	Very small, can only be seen through a microscope.
migrate	To move from one place to another; for instance, many species of birds migrate south during the winter.
mineral	A naturally occurring, non-living substance which has a definite chemical composition and a characteristic crystalline structure, hardness, and color.
ocean	A large body of salt water. There are five oceans on the earth: Pacific, Atlantic, Indian, Arctic and Antarctic.
old-growth forest	A forest that has been undisturbed for hundreds of years and is in a stable condition with climax vegetation.
oxygen	A gaseous element. It most frequently exists as O_2 and is necessary for life.
permafrost	A permanently frozen layer at variable depth below the earth's surface in frigid regions.

photosynthesis	The process by which a plant makes food from sunlight, water, and carbon dioxide.
phytoplankton	Microscopic floating plant life; plant life plankton.
placer mining	Mining of mineral deposits by washing, dredging, or other hydraulic means.
plankton	Organisms, usually microscopic, which float passively or swim in their aquatic environment. Food source for many marine animals.
pollution	Contamination of natural resources with man-made wastes.
population	The number of particular species in a given area.
precipitation	The falling of water to the earth in the form of rain, snow, sleet, etc.
predator	An animal that hunts other animals for food.
prey	An animal that is hunted as a food source by other animals.
rain forest	A dense, evergreen forest that has abundant rainfall throughout the year.
second-growth forest	A forest that grows up after fire or clear-cutting. It will be going through succession until it becomes an old-growth forest.
silt	Mineral particles intermediate in size between sand and clay.
solstice	The day of summer or winter when the sun reaches its highest or lowest point in the sky; the longest or shortest day of the year.
spawning	The process fish use to lay and fertilize eggs.
soil	The top layer of the earth's crust, suitable for the growth of plant life.
succession	The slow change in the types of species of plants and animals found in an area until the climax or stable community is formed.
taiga	The coniferous forests of the northern part of the earth.
toxic waste	Chemical waste materials that are harmful to health.
thermokarsting	Creating an irregular, hummocky surface through the thawing of the permafrost.

transpiration	The process in which a plant releases water vapor to the atmosphere.
tree line	Timberline; the upper limit of tree growth at high latitudes or high altitudes.
tundra	Treeless areas between the tree line and the perpetual snow line; found in the polar regions and on mountains.
upland taiga	A type of taiga characterized by drier conditions and white and spruce birch forests.
vapor	The gaseous state of any substance.
water cycle	The physical states of water (solid, liquid, and gas) and the physical changes between those states (precipitation, evaporation, and condensation).
web	The intricate interrelationships of life and the physical environment.
wetland taiga	A type of taiga characterized by saturated soils and black spruce forests.
Yupik	Eskimo people found most often in southwestern Alaska.
zooplankton	Microscopic floating animal organisms; animal plankton.

Resources

Video Material

Unless otherwise noted, most of these films are available in six or more university film libraries. Contact the film reference librarian at your local university film or media services to find out where to order the film you want.

Animal Adaptation in a Northern Environment
BFA Educational Media, 1970
Intermediate through secondary school
11 min. 16 mm

Film shows behavioral and structural adaptations developed by animals that live in the tundra. Available from Alaska State Film Library and at least six American universities.

Ecology of the Arctic
American Institute of Biological Science, 1967
Junior and senior high school
16 min. 16 mm

Emphasizes adaptations of organisms to some limiting factors in the tundra. Describes food relationships and population cycles existing in the tundra. Seasonal concepts are defined in terms of average daily temperature. (Alaska State Film Library, University of Minnesota, Washington State University)

Ecology of the Arctic
Ecology of the Ocean
Prod. Palisades. Dist. AIMS. 1972
Intermediate through high school
Arctic—11 min. *Ocean*—7 min. 16 mm

Two films from the *Ecology of the U.S.* series. *Ecology of the Arctic* shows how living organisms have adapted themselves to the forbidding environment. Narrated by William Shatner.

Ecology of the Ocean depicts ways man has tampered with the natural balance of the ocean. The film highlights effect of oil drilling on several bird species. Narrated by George Maharis.

Life on the Tundra
National Film Board of Canada
Intermediate
14 min. 16 mm

A photographic study of the characteristics of the Canadian tundra. The film explores plant and animal survival in the arctic climate and shows effects of glaciers and freezing on the surface land features.

Sea School
Prod. by Alaska State Dept. of Education, 1983.
Intermediate, junior high
Eight 15-minute video programs with teacher's guide

The programs present Alaska fish and the fishing industry, basic marine biology, management techniques and issues, and the cultural and economic importance of key fish species. (Agency for Instructional Technology)

Top of the World: Taiga, Tundra, Ice Cap
International Cinemedia, Montreal, Canada, 1972
23 min. 16 mm

Film examines the resources of the polar region and points out the possible consequence of exploration of these resources without sufficient concern for the land and the balance of nature.

Books

Lambert, David and Anita McConnell. *The World of Science: Seas and Oceans.* London: Orbis Publishing, 1985, and New York: Facts on File, Inc., 1985.

Large format. Illustrated with full color photographs, maps, and graphics. Chapters on "Our Watery World," "Shores and Islands," "Life in the Sea," "Animals with Backbones," "Man and the Sea" with Glossary and Index. For intermediate and middle school readers.

McPhee, John. *Coming into the Country.* New York: Farrer, Straus and Giroux, 1976.

The volume comprises three books. "The Encircled River: At the Northern Tree Line" is about a canoe and kayak trip on rivers north of the Arctic Circle. "What They Were Hunting For: In Urban Alaska," uses the issue of choosing a new Alaskan state capital to examine the unique characteristics of Alaskan society. "Coming into the Country: In the Bush" describes the people and land of the upper Yukon. Taken together, the volume presents a personal but highly informed picture of the relationship of a small and extremely varied populace to an immense land. For advanced readers.

Mitchell, John Hanson. *A Field Guide to Your Own Back Yard.* New York and London: Norton, 1985.

The book offers information on the wilderness that exists in empty lots, suburban parks, back yards. Arranged in order of seasonal occurrence, it shows that the same natural laws and ecological dynamics that operate in wilderness areas govern natural life close to home.

Parks, Peter. *The World You Never See: Underwater Life*. Chicago, New York, San Francisco: Rand McNally, 1976.

Illustrated with detailed underwater and microscopic photography in color by the author and Oxford Scientific Films. Deals with salt and freshwater life and ecology. Text tells of photographic team's discoveries and adventures while filming and explains scientific facts and phenomena.

Sage, Bryan. *The Arctic and Its Wildlife*. With contributions from Dr. Hugh Danks, Dr. Eric Haber, Prof. Peter G. Kevan, and Dr. Thomas G. Smith. New York and Oxford: Facts on File Publications, 1986.

A serious account of landforms and wildlife aiming to bridge a gap between highly technical literature and popular accounts. Contains plates, tables, figures, appendices on birds and mammals, lengthy references, and an index. For advanced readers with background in ecology and science.

Time-Life Books

The various series published by Time-Life Books are widely available and offer excellent resources for students who wish to pursue subjects in ecology or about Alaska. Younger students will appreciate the pictures and informative captions. Older ones will make greater use of the readable text, maps, index, and bibliography. Among these books are the following:

Brown, Dale and the editors of Time-Life Books. *Wild Alaska*, in the American Wilderness series. Alexandria, VA: Time, 1972.

Engel, Leonard and the editors of Time-Life Books. *The Sea*, rev. ed. in the Life Nature Library series. Alexandria, VA: Time-Life Books, 1980.

Farb, Peter and the editors of Time-Life Books. *The Forest*, rev. ed. in the Life Nature Library series. Alexandria, VA: Time-Life Books, 1980.

Farb, Peter and the editors of Time-Life Books. *Ecology*, rev. ed. in the Life Nature Library series. Alexandria, VA: Time-Life Books, 1980.

Leopold, Luna B., Kenneth S. Davis, and the editors of Time-Life Books. *Water*, rev. ed. in the Life Science Library series. Alexandria, VA: Time-Life Books, 1980.

Thompson, Philip D., Robert O'Brien and the editors of Time-Life Books. *Weather*, rev. ed. in the Life Science Library series. Alexandria, VA: Time-Life Books, 1980.

Whipple, A. B. C. and the editors of Time-Life Books. *Restless Oceans*, in the Planet Earth series. Alexandria, VA: Time-Life Books, 1983.

Textbook Correlation

This matrix correlates each ***Ecosystems of the Great Land*** program with widely used junior high and high school life science textbooks in the following six textbook series. (The numbers in the matrix correspond to page numbers in the cited textbooks.)

Addison-Wesley
Life Science, 1989.

Heath
Life Science, 1984. Teacher's edition.

Holt, Rinehart and Winston
Life Science, 1986. Teacher's edition.

Macmillan
Life Science, 1989.

Merrill
Focus on Life Science, 1987. Teacher's edition.

Scott, Foresman
Life Science, 1983. Teacher's edtion.

	Program 1 Introduction to Ecosystems	Program 2 Tundra	Program 3 Taiga	Program 4 Coastal Forest	Program 5 Oceans	Program 6 Impact of Human Habitation
Addison-Wesley	463–470, 481–484	496–501, 512 517	496–501, 512, 517	495–502	519–529	535–542
Heath	67–85, 151–153	156–157	157–162	157, 248–253	155, 162–163,	331–351
Holt, Rinehart and Winston	437–441, 448–452, 487–489	509–511	454–455	443, 457–459, 491, 493–494	513–516	521–535
Macmillan	452, 455–458	467, 469	464–466	460–461	470–473	480–492
Merrill	509–516, 483–490	500	179, 500	490, 518		531–547
Scott, Foresman	433–436 450–451	433–435, 450–451	433–435, 444–445	433–435, 442, 453	433–435,	457–475

Notes

Other AIT Series

...on Alaska

Alaska

Produced by Alaska State Department of Education

Five 15-minute video programs for junior high and high school history classes on Alaska and its history—often neglected in American history. This visually rich series traces Alaska's history from the advent of the Native American peoples to the modern day. Programs in the series have won first place for American History in the National Educational Film and Video Festival, the Ohio State Award, three CINE Golden Eagles, and the Silver Medal at the New York International Film and Television Festival. Comprehensive teacher's guide with textbook correlation.

Programs
1. The Mists of Time
2. Age of Discovery
3. Folly or Fortune
4. Mary Nell: Adventures of a Pioneer
5. The Silver Years

Purchase Price
The programs may be leased for broadcast or purchased on videocassette for $125 each or $495 for the entire series. Contact AIT to preview.

Sea School: Alaska Fisheries

Produced by the Alaska State Department of Education

Eight 15-minute programs for high school students in science, social studies, geography, and economics. Programs in the series have won the Ohio State Award, ACT Award, and three CINE Golden Eagles. The series is accompanied by a teacher's guide.

Programs
1. Beneath Alaska Tides
2. King Crabber
3. The Herring Chase
4. So There Will Always Be Salmon
5. Joint Venture
6. Fishin Impossible
7. Bouillabaise
8. The Halibut Rush

Purchase Price
The programs may be leased for broadcast or purchased on videocassette for $125 each or $795 for the entire series. Contact AIT for preview.

...on Ecology and the Environment

Bioscope

Produced by Mississippi Authority for Educational Television in conjunction with AIT

Eight 15-minute programs for intermediate, junior high, and high school students of ecology and life sciences. The programs feature locations from the Amazon to the Arctic and living things as small as algae and as large as whales. It presents such concepts as web of life, adaptation, the food chain, life cycles, and interdependence. Programs in the series have won the Chris Statuette, Columbus Film Festival, SECA Elementary Instructional Design Award, and the Ohio State Award. A 20-page teacher's guide accompanies the series.

Programs
1. Bioscope: The Life Sciences
2. Cells
3. The World of Living Things
4. Where Plants and Animals Live
5. Adaptation
6. The Natural Balance
7. Endangered Species
8. Frontiers in the Biosphere

Purchase Price
The programs may be leased for broadcast or purchased on videocassette for $125 each. Contact AIT to preview.

Forever Wild

Produced by WCFE-TV, Plattsburgh, New York

Four 15-minute programs for intermediate and junior high students in social studies, ecology/life sciences, and history. Remote mountaintops, fragile forests, tumbling rivers, and the wildlife inhabitants of the Adirondack and Catskill wilderness areas introduce viewers to the concepts and history of conservation, ecology, and land management. Winner of the CEN ITV Award, the series is accompanied by a 24-page teacher's guide.

Programs
1. New York's Final Frontier
2. A Call to Action
3. What Good Are Woods?
4. Stewardship

Purchase Price
The programs may be leased for broadcast or purchased on videocassette for $125 each or $395 for the series. Contact AIT to preview.

Contact AIT AV Instructional Services for more information or to request a catalog.

Agency for Instructional Technology
Box A
Bloomington, IN 47402-0120
Telephone: 800/457-4509 or 812/339-2203
in Canada: 416/963-5979

Evolving from a television library begun in 1962, the nonprofit American-Canadian Agency for Instructional Technology (AIT) was established in 1973 to strengthen education through technology. AIT pursues its mission through the development and distribution of video and computer programs and printed materials in association with state and provincial education agencies. In addition, AIT acquires, enhances, and distributes programs produced by others. AIT programs are used in schools throughout the United States and Canada. The agency is based in Bloomington, Indiana.

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